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THE ATLANTA EXPOSITION.

The opening at Atlanta last week of the Cotton States and International Exposition was an event of much significance, marking, as it does, the success of an industrial revolution in the South little realized by many. Even a decade ago, the States of the South were looked upon as having little in common with their northern sisters, but the present Exposition will furnish a magnificent object lesson of the great changes wrought in a few years—changes which associate in thought Georgia with New York and Illinois, Alabama and Tennessee with Pennsylvania, and even sections of South Carolina with the cotton manufacturing districts of New England. The Exposition in every particular gives evidence of the progressiveness of the New South and of the enterprise of those to whom its present position is due. In fact, it is perhaps to the latter quality rather than to material advantages that the Exposition will owe much of the great success which promises to be attained, for those in charge have demonstrated that they possess the "hustling" abilities which heretofore have been considered the peculiar characteristics of the Westerner. In future issues we shall publish an account of the various electrical features of the Exhibition, some of which at this writing have not arrived at completion.

A STANDARD LAMP BASE.

The question of the adoption of a standard lamp base is again being brought before the electrical public, and it is to be hoped that the agitation will continue until this much desired end is achieved. In the day of "systems" every electrical manufacturing company painfully strove to have every part of its "system" bear the stamp of originality, to attain the semblance of which resort was often had to the most puerile expedients. For a large company then not to have its own particular form of lamp base was apparently thought to imply a confession of inferiority of inventive ability which would reflect upon its "system" as a whole. As a result, but a few years ago there were a half score different bases in use, to the mystification of the lamp user and the despair of the supply dealer. At present this number has been reduced to practically two, though sockets for a third type of base are yet being installed. Were there any question as to the merits of the different bases, there might be a reluctance on the part of some lamp users to replace the type which they may consider possesses superior points, but we are inclined to believe that no such difference of opinion exists. It will, however, be a matter of no little difficulty to secure the establishment of a standard base. The enormous number of sockets now in use corresponding to present bases will not require renewal for many years, and even as they become worn out some users will not welcome a plan which necessitates keeping two kinds of bases in stock; this opposition may, however, be met by the adoption of a base which can be simply adapted to the several types of sockets to be eventually displaced. As to the type of standard base, it would appear to be entirely out of the question to adopt any of the present ones, as such a plan would require one of the two great electrical companies to use the base of its rival, which is little likely to be done. The matter then seems to reduce to the perfection of a base differing from those now in use and admitting of being adapted to the present types of sockets. The supply dealers and lamp manufacturers, who are, perhaps, the ones most interested in the proposed measure, would do well to bring it before the coming convention of the National Electric Light Association. With the

support of this body the matter would be given a disinterested standing before the public which would largely insure a success that otherwise would be difficult to attain.

SUPPOSED FAULTS OF MULTIPHASED SYSTEMS.

In a paper read at the Ottawa Convention of the Canadian Electrical Association on "Some Modern Alternating-Current Apparatus," it is stated that multiphased systems are subject to the serious disadvantage that the circuits must be kept balanced. As the author follows up the statement by advocating in fulsome terms a competing system which is declared to have all of the advantages of all other alternating systems and none of their disadvantages, his point of view can scarcely be considered disinterested, but is none the less mischievous. Through like statements made on similar occasions, an impression has been created and widely extended that multiphased systems are impracticable for general use for the reason that their several circuits will not admit of being unbalanced. While it is true that theoretically perfect conditions are only attained when such circuits are in balance, it is also true that multiphased systems will operate entirely satisfactorily within the limits that are likely to exist with respect to balance in any practical installation. We will add that we make this statement on the best of authority, and it is, moreover, upheld by the verdict of practice. At the Cleveland Convention of the National Electric Light Association, a central station man operating a two-phase system said that no trouble had been experienced when one of the two circuits, each of which carried both light and power, had a load 50 per cent. greater than the other. At an exhibition of a two-phase system, several months ago, the circuits were so arranged that the loads could be unbalanced 20 per cent., and no effect on the lights was noticeable when such a change was made. It is in one respect unfortunate that the phenomena of alternating currents have become well known, for the general knowledge now possessed with respect to them is apt to be misapplied, to the detriment of the industry. If in the days when the simple alternating current was first introduced the phenomena of inductance and hysteresis had been well known, the growth of the alternating-current industry would probably have been seriously retarded ; for how wisely would it have been argued that in competition with the system then in use, there would not be a ghost of a chance for one whose regulation was handicapped by both inductance and transformer drop. Not being withheld by the existence of such doubts, the alternating people went ahead and produced results that were satisfactory from a practical standpoint. Even at the present day a theoretical consideration of the disadvantages of the simple alternating system with respect to regulation is likely to raise doubts which, however, are as soon dispelled by a remembrance of the fact that, grave as the objections may seem to be, they have no weight in practical working. Criticisms not based on actual practice or upon quantitative calculations are worthy of little consideration and should be so treated.

CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION.

In commenting from time to time during the last two years on the meetings of the various national and other electrical associations, we have had occasion to remark in almost every case that the meeting was the most successful in the history of the body represented. The business depression prevailing during the greater part of that time had rather a quickening influence than otherwise, and with the return of better times no abatement is noticeable, as recently shown at the convention of the Northwestern Electrical Association and again last week in the marked success of the Ottawa meeting of the Canadian Electrical Association. The latter occasion, as will be seen from the account printed elsewhere in this issue, was almost purely of a social and professional character, the commercial interests being almost entirely unrepresented. While this condition would meet the views of some of the members of other electrical bodies, yet there seems to be no reason why there should not be mutual benefit in the trade exhibition auxiliary if it be kept properly subordinate to the main end instead, as has sometimes been the case, of entirely overshadowing it. Two of the most interesting papers read at Ottawa had for their subject the present electric lighting plant of that city, which, as may be judged from the description in our issue of last week, is one of the finest on the continent. Mr. Dion, in his paper, describes how the plants of the three rival companies formerly in the field are being combined into a homogeneous system. Among the points worthy of note in this connection are that it was found advisable to maintain the arc-lighting service as an entirely separate department; the feeder and pressure wire incandescent system, where formerly in use, was displaced by the compensator system, and after trying alternating parallel running it was abandoned, the generators instead being rigidly coupled in pairs and their armatures connected in multiple. In the other paper relating to the Ottawa company, Mr. Street illustrates the order which reigns in the accounting department, and directs particular attention to the method of keeping meter customers' accounts. A feature of some of the forms used in this latter connection is a printed fac-simile of the meter dial, on which the position of the several hands are indicated, the reading being made in the office; by this means errors in transcription are reduced to a minimum, and the customer is enabled to more simply check his meter. The paper of Mr. Dwight on "The Telegraph in Canada," brings out the unexpected fact that no country in the world can boast as large a proportion of telegraph offices with respect to population as Canada, the number per thousand of inhabitants being 2.4 times greater than in the United States; this superiority is, however, probably due to a smaller proportionate number of large centres of population. The percentage method for circuit measurements described by Mr. Keeley seems to be identical with a familiar text-book method of determining resistance, but from its simplicity deserves to be thus made better known. The paper of Mr. Milne is principally a protest against the low efficiency of the steam engine. The first duty of a teacher of steam engineering should be to thoroughly impart the fact that the practical efficiency of the steam engine should not be computed upon a thermodynamic basis, as is here done. The thermal inefficiency of the steam engine is the result of a law of nature that can never be overcome in a heat engine, and it is absurd to introduce the factor in calculating practical efficiencies. The only factors over which man has any real control are those relating to the working efficiency of the steam and the mechanical efficiency of the engine mechanism; in the best modern engines the former is something more than 75 per cent. and the latter over 92 per cent., from which it follows that, practically, the steam engine is far from being the inefficient machine it is generally supposed to be. It should also be borne in mind that any method of transforming heat into work is handicapped by the same conditions with respect to thermal inefficiency, as the steam engine. If electrical energy is ever obtained direct from heat, the theoretical efficiency will similarly depend upon the ratio of the absolute temperature limits of working, and the heat working and mechanical efficiency will be little likely to exceed that of the modern steam engine. The paper of Mr. Hartman on "Some Modern Alternating-Current Apparatus," we refer to elsewhere in these columns.

The Use of the Personal Pronoun.

The British Institution of Civil Engineers in its instructions for preparing papers to be read at its meetings, requests that the use of the personal pronoun be avoided.

An Electrical Testing Patent.

In the suit of the Western Electric Company against the Brush Electric Company on patent No. 476,317, issued to C. H. Rudd, June 7, 1892, for a system of testing electric circuits, a final decree was entered on Sept. 19, by Judge Showalter, of the United States Court, finding the patent valid, and infringed by the Brush Electric Company. The patent in question covers a system of locating grounds and other troubles on an electric light circuit, by means of an artificial circuit of high resistance at the generating station and adapted to be connected to a line circuit; the resistance of the artificial circuit is fixed and so apportioned between contact points that the attendant, by means of a testing set, may find the neutral point in the artificial circuit corresponding to the neutral point of the line circuit connected therewith.

An Important Street Railway Decision.

Judge Fenn, of the Connecticut Superior Court, on Wednesday of last week rendered a decision of vital importance to all Connecticut railway companies, and of no small interest to others throughout the United States.

The City Council of New Britain, Conn., refused to grant permission to the Central Railway & Electric Company to extend its tracks in certain streets, and the latter brought suit to obtain the desired right of way. The court sustained the city officials, on the ground that to give the use of the streets without compensation to a railway company is a violation of Article 14, Section 1, of the Constitution of the United States, which provides that no town or city can dispose of public property to the injury of the community or municipality.

Under the law passed by the late general assembly of Connecticut, a Superior Court case is not appealable in that State.

Magnetic Units.

The discussion on the subject of magnetic units invited by the editors of the London *Electrician* still continues in the columns of that journal. In an editorial comment upon several of the letters which we extract below, it is said that Dr. Lodge makes a good point when he urges that "Those who hold that no simple multiples are of any use ought to speak of an event as going to occur in 15,834,000 seconds instead of three weeks." The *Electrician* replies that no one does hold that simple multiples are in no cases useful, but that as far as concerns the total flux in big dynamos which, when measured in *lines*, certainly run into big figures, the dynamo designer, who alone experiences the alleged awkwardness of these large totals, does not appear to feel any inconvenience. Commenting on Dr. Sumpner's wish that the names of units for use as practical names should be allowed to evolve themselves, and that such names should be self-explanatory, it is stated that while this wish is shared largely by others, the drawback is that it leads to the evolution of different compound names in each country, and, in some degree, to the evolution of different units; while the disadvantage would not, perhaps, be so very formidable in fact as in imagination, since neither the French nor the German rendering of ampere-turns, sec-ohm, or volt-line, would be unrecognizable to Englishmen, the difficulty lies in securing the adoption of the same word-mixture in every country.

Following is the letter of Dr. Lodge in full:

"The reluctance to extend to magnetic units the same sort of treatment as has proved successful with electric units is somewhat surprising. There are some who hold that such a statement as that $\mathsf{N}^* = 10$ is sufficient, but I hope that Prof. Ewing will, after consideration, dissociate himself from these, inasmuch as it could only be accurate if N were a pure number. As it stands, it tells us nothing, any more than the statement that 'the depth of the sea at a certain bar is 60' has any meaning unless we are told whether feet or fathoms are meant. It is true that a unit equal to 10^8 C.G.S. is large, but a unit of 1 C.G.S. is just as much too small, for dynamo purposes.

"Those who hold that no simple multiples are of any use ought to speak of an event as going to occur in 15,834,000 seconds, instead of in three weeks; and they should express the distance from here to York in feet or inches.

"There are certainly two quantities on which agreement is needed. If 'lines' and 'ampere-turns' respectively are held sufficient by a decided majority of those concerned, very good—let them be agreed upon; but it cannot be good for every one to be devising a unit of his own. (And, by the way, I have nowhere urged people to make the henry of any size other than the secohm, as Prof. Ewing seems to imagine.)

"The idea underlying my draft suggestions was mainly that it was well to consider the entire aspect of the question before finally deciding on the units for even these two essential quantities."

The letter of Dr. W. E. Sumpner is as follows:

"Dr. Lodge's suggestions chiefly refer to three units for quantities intimately related to $\mathfrak{H}$, $\mathfrak{B}$ and L.

"First, as regards $\mathfrak{H}$. Since $\mathfrak{B} = \mu\,\mathfrak{H}$, the magnetism induced in a magnetic circuit easily follows from $\mathfrak{H}$. Considering an anchor ring of iron with n turns of wire round it carrying a current of A amperes, and supposing l is the circumferential length of the core, then

$$\mathfrak{H} = \frac{4\pi}{10}\,\frac{n\,A}{l}.$$

A being in amperes, and l in centimetres, $\frac{4\pi}{10}\,n\,A$ is called the magnetomotive force = M.M.F., and total lines $= \mathfrak{B} \times \text{area} = \mu\,\mathfrak{H} \times \text{area} = \frac{\text{M.M.F.}}{\frac{l}{\mu\ \text{area}}}$, and $\frac{l}{\mu\ \text{area}}$ is called the magnetic resistance.

"Dr. Lodge suggests a name for the unit of M. M. F. But really there is *one in use*—viz., the ampere-turn, and M. M. F. $= \frac{4\pi}{10} \times$ ampere-turns.

"The constant is of no importance to practical men—they are so used to them in their formulæ. The $\frac{4\pi}{10}$ cannot be got rid of. Mr. Heaviside proposes to alter the size of the ampere, so as to get rid of it in this equation (and this would involve changing either the ohm or the volt to correspond). Is it ever likely this suggestion will be adopted?

"Then, as regards $\mathfrak{B}$, Dr. Lodge proposes a name not for $\mathfrak{B}$ exactly, but for $\mathfrak{B} \times \text{area} = \mathsf{N}$ = total number of lines. In this I quite agree, but the point is that with few exceptions every one already uses the word *line* for this purpose, sometimes with the prefix 'magnetic,' sometimes with the affix 'of force,' and sometimes alone; but all use the word line, and, strange to say, nearly all people, practical and theoretical, use the C. G. S. unit for N, although when the density of line is considered, some use N per square centimetre (or $\mathfrak{B}$), others N per square inch, and others use the Kapp unit. Now it seems to me a pity to try to substitute any word for *line*. As regards the unit corresponding with the volt and ampere—*i.e.*, 10^8 lines, opinions differ as to whether the unit is wanted or not. Whenever I have had occasion to use it, I have employed the word *volt-line* for the purpose. But I think the unit can very well be done without for the present.

"Then as regards L; this only becomes of practical interest when iron is used, and then it is such a variable quantity that only by a stretch of the imagination can it be said to exist. Since L is only of importance as a means of calculating the number of lines N from the current strength, it is best when L is variable to calculate N by the ordinary method of the magnetic circuit, and to leave out L altogether.

"Then as regards units generally, I disagree with the idea of naming units after celebrated men. First, one has to find a unit which is wanted, then to make successive international congresses agree to sink their national prejudices, and, finally, to make 'practicians' adopt the name. Which task is most difficult is hard to say, but, having done all this, people have yet to be taught the meaning of the name. My own idea is that units should grow up themselves as they are wanted, in the manner exemplified by the word 'ampere-turn.' This has simply been compounded of the words which in the shortest way explain its meaning. It has not been authorized by any congress. It has simply grown up in a natural way, and in spite of congresses it will last. Another word like it is secohm. This word has been smashed, pulverized and destroyed by two or three scientific gatherings—the B.A., and the French, and the American Congresses. Yet where is the word 'quadrant,' and where is the word 'henry'? No one seems quite certain what henry means, but the word secohm explains itself; and, in spite of the word secohm being thrown over three times, it is yet to be discussed at the next B.A. meeting. The reason is that the word is founded on a rational system, whereas henry has nothing but sentiment to recommend it. Though the term volt-line for 10^8 lines has, as far as I know, never been used, I cannot help thinking it a much better word than 'weber,' or 'gauss,' or any

* The corresponding symbol in the International Congress system is Φ.

such name having no apparent connection with what it is supposed to represent.

"If a unit is very badly wanted, of course people may agree on a name like ohm, ampere, or volt. But as a rule these units are *not* badly wanted, and it is best to let the names grow up by themselves in the way suggested. A 'volt-line' is such that when a circuit loses lines of force at the rate of one 'volt-line' per second, the E.M.F. generated in the circuit is one volt. Hence the name. One can easily imagine names being given in this way. There is no national jealousy to delay the adoption of a name founded in this manner, for it is chosen for convenience and explicitness merely."

Mr. Lewellyn B. Atkinson advocates the adoption of a unit of self-inductance. He considers that whether the absolute C. G. S. system is the best or not is a question which it is now too late to discuss; it, at least, has the advantage of consistency and simplicity, and taking, as it does, three fundamental arbitrary quantities, the memory is burdened with few constants. In the practical system, however, this simplicity is at once lost, and practical units in new lines of design or investigation, involving perhaps mechanical and perhaps thermo-dynamical quantities, lead to hopeless muddle. He regards all practical units as an unmitigated nuisance, and views the augmentation of the number with alarm. He advises the giving of names to the absolute units, for by so doing the statement of quantity is simplified, but he condemns as a new burden the introduction of new arbitrary multiples under the name of practical units.

Mr. Albion T. Snell considers that the first quantity to be determined in designing dynamos is evidently the total magnetic flux, the name of which, he thinks, is of little importance, much less that of the unit. He calls this quantity "lines," and denotes it by the symbol **N**. He considers the name of the unit of magnetic intensity to be of no importance, nor that of magnetomotive force, as this quantity is most readily and obviously expressed in ampere-turns. If, he says, by changing the unit of these quantities, it would tend to make the reluctance vary as the magnetomotive force divided by the total lines—that is to say, to follow a simple law like that connecting E, C and R—it would be worth while to make the change; but as it appears that the permeability of iron does not follow a straight line law, then no equation can be of use in practice, except in conjunction with tables showing the permeability. The $\frac{4\pi}{10}$ difficulty is pronounced as of little importance in designing work, as it is easily included in the calculations for determining the tables or curves, which are now used by every man who has to get his living in this branch of engineering. In designing alternators, he says that the matter is more complicated owing to the inductance, but that it is possible to design very good alternators without a knowledge of the exact meaning of a henry, and many designers build their machine first and determine this afterward. The unit of inductance, he says, should be defined in a simple manner which would lend itself to practice.

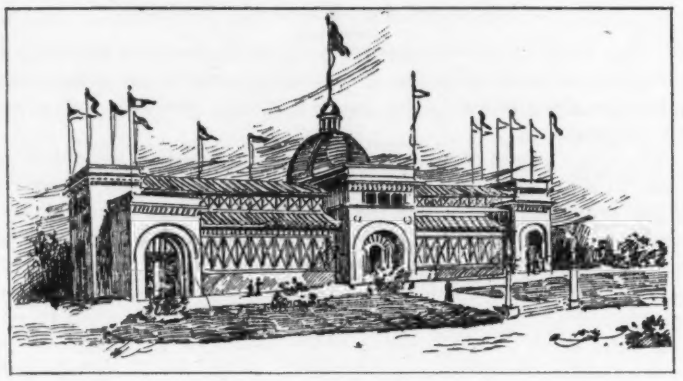
Mr. W. B. Sayers states that he has not experienced any need of new names for magnetic units. If only the C. G. S. system is taken for granted, nothing more is required than the number expressing the quantity of the thing in question. He thinks that if the question is asked, "What is the unit of self-inductance?" the reply sought for is invariably not the *name* of the unit but the definition of it. He agrees with Professor S. P. Thompson, that there should be no "academic fatuities" as to whether $\mathfrak{B}$ stands for flux in air or in iron. The total flux is the same through all parts of a magnetic circuit, and its inductive effect the same in changing, whether it exists in air or in iron; the fact that in air as in all other substances, $\mathfrak{B}$ is equal to $\mathfrak{H}$ should lead to no confusion, but rather towards clear relationship and simplicity.

Mathematics and Engineering.

In an appreciative review in the London *Engineer* of the 1894 volume of the *Transactions* of the American Institute of Electrical Engineers it is said that a few years ago the Untted States would have been the last place in which to seek elaborate mathematical theorizing about all-round engineering problems. "It is, indeed, doubtful if anybody does seek it; it seems to bubble out in some places, a pretty sparkling stream at first, but no sooner coming into contact with things terrestrial than it generates mud—thick, or sometimes sloppy, mental mud." The writer of the review adds, however, that he does not wish for a moment to disparage the importance of the mathematical investigation of complicated electrical, or, indeed, of any other engineering, problems.

The Atlanta Exposition.

The Cotton States and International Exposition at Atlanta was opened on Wednesday, September 18, by President Cleveland, who, at Gray Gables, touched a button which started the machinery. In Machinery Hall electric valves had been attached to the Frick engine and a four million gallon pump, and when the President touched the button, the current opened a small valve, which actuated a larger one, which in turn admitted the steam to the cylinders. Mr. Charles F. Foster, engineer of the Exposition, was sitting by the large engine, waiting for the signal from the President, and when the valve clicked and the steam poured into the cylinder, he gave a signal to the engineers awaiting, and at once all the machinery was started. On the banks of the artificial lake, Clara Mere, Mr. Luther Stieringer directed the operations of the fountains. A single jet



Electricity Building.

from the centre suddenly began spouting, and as it rose above the banks of the lake, a salute of one hundred bombs was thrown into the air by the fireworks department, which notified the crowds about the building that the Exposition was opened.

All of the exhibits are not yet placed in the electrical building, but are rapidly being installed. The building is 280 feet long by 75 feet wide, the central portion being capped by a handsome dome. The exterior framework is covered to the window sill line with two-inch planks about 14 inches in width, separated by filling-pieces 2 by 1½ inches, so as to form a natural base for the superstructure, which, together with the roof, is covered with plain square yellow pine shingles. Nothing but yellow pine has been employed on the buildings with the exception of "staff" ornamentations and finishings in various places.

In a future issue we shall describe, after the installation of the exhibits has been completed, the various features of the electricity building and exhibits.

The B. & O. Electric Locomotive.

Tests have recently been made by the Baltimore & Ohio officials with a view to increasing the service of the electric locomotives. The plans include extensions from both the north and south ends of the tunnel. At present the electric locomotives are detached in the middle of a steep grade, and the uncoupling is done at the worst part. It is now proposed to change the locomotives at the summit.

Tests have been going on for some time to determine the extent of the pulling capacity of the locomotives. At a recent test made where the grade is 42 feet to the mile, the engine was attached to a train of 27 loaded cars and two dead locomotives. The weight, including the electric engine, was 1,222 tons. Every draw-bar was tight and there was no slack. The train was then started, and within one minute it was moving at the rate of 10½ miles an hour, from which point the speed was increased to the usual figure. The train resistance was 26 pounds per ton, of which 16 pounds was due to the grade pull.

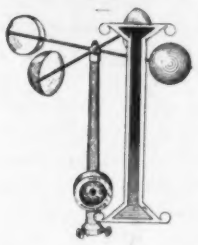
The trial is considered remarkable, especially in view of the fact that the rails were greasy and damp.

Motors on Warships.

The heavy guns of three British battle ships now being constructed will be worked by electricity, and electric gun hoists are to be installed on these and other men-of-war.

Electrical Recording Instruments of the Weather Bureau.

BY ELISHA C. VOSE.



IN the wonderful development and improvement that has been made in electrical apparatus in the last few years, the Weather Bureau has not been behind the times; so that now an entire observation of the several different elements that go to make up a record of the weather, such as the barometric pressure, the temperature, the direction of the wind, the velocity of the wind, the sunshine and the rainfall, can all be taken by means of automatic, self-registering instruments without going outside of the office. The most of these instruments that are in general use at stations of the first order, record by means of electricity, and it is of these that a brief description will be given.

The glass electrical sunshine recorder is the name of the instrument used to register the sunshine. (See Fig. 1.) It is on the principle of the differential air thermometer and consists of a straight glass tube with cylindrical bulbs at each end, the one at the lower end being covered with lampblack, all enclosed in a glass sheath. The bulbs are filled with pure dry air and sealed at a temperature of —5° F. to secure greater density of air, and the air in the two bulbs is separated by a column of mercury. The space between the tube and the sheath is exhausted of air and sealed. A small amount of mercury is also inserted in the blackened bulb. When the sun is shining the blackened bulb more readily absorbs heat than the plain one, and this causes the air in the blackened bulb to become warmer and forces the mercury to expand; so that, so long as the sun continues to shine, a mark is made on the register every minute by an automatic attachment in the clock of a triple register, which causes the electric circuit to be closed. But when the sun is obscured by clouds, an equilibrium of temperature is established between the columns of air in the two bulbs, and the mercury falls in the blackened bulb. Every minute during the time that the sun is shining, a mark is made on the register. This record is tabulated, entered on a monthly sheet on a basis of hours and tenths, and from this the total percentage of sunshine is obtained for the month.

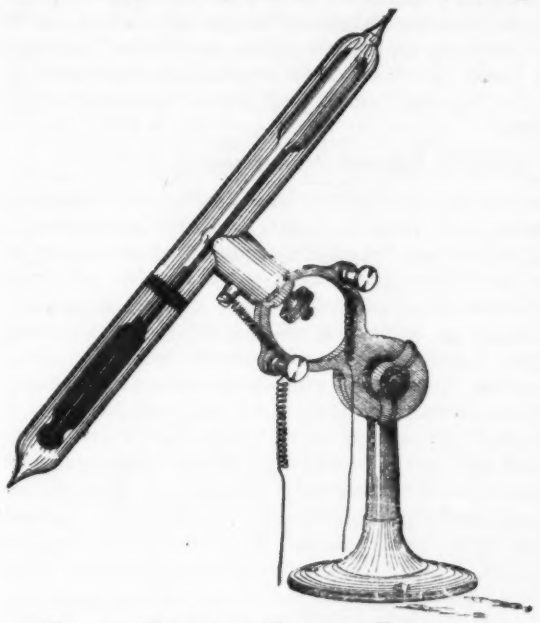
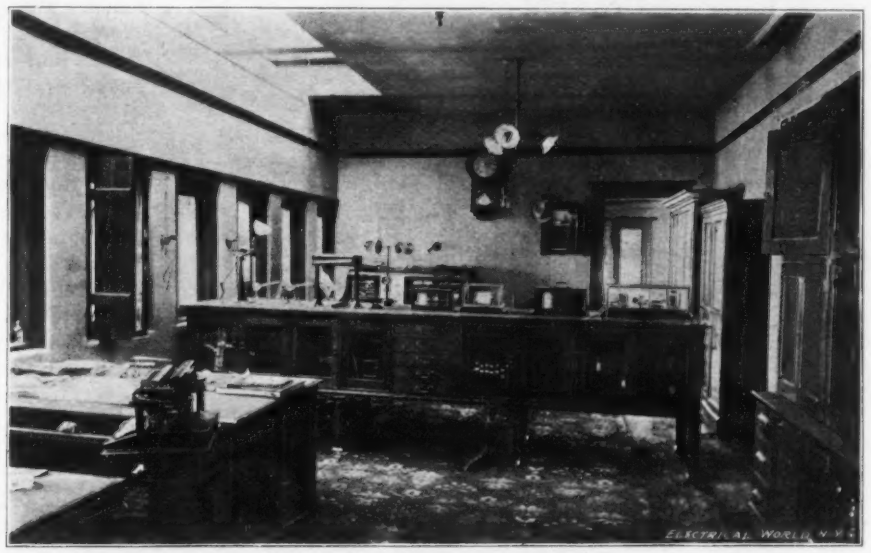


FIG. 1.—ELECTRICAL SUNSHINE RECORDER.



A WEATHER OFFICE.

The anemometer is the instrument used to record the velocity or force of the wind. (See initial.) It consists of four hemispherical cups, securely fastened to a spindle, which connect with a series of cog wheels in the dial of the instrument. Five hundred revolutions of the cups cause the dial to move one notch, and a contact is then made in the dial, which causes the electric current to pass through a magnet in the triple register, and this draws the pen to it; thus making a mark on the sheet for each mile of wind traveled. If the wind is blowing at a greater or less rate of speed, the marks on the sheet are either closer together or farther apart, as the 500 revolutions are completed in a shorter or longer period of time. These data are tabulated and entered on a monthly sheet, the actual number of miles traveled being entered for each hour, and the total number of miles for each day; thus the total number of miles traveled for the month is obtained, and from this the average hourly velocity for the month. When a storm velocity occurs, *i. e.*, when the wind is blowing at the rate of 40 or more miles per hour for five-minute intervals, these data are entered on another sheet, showing the exact time at which the wind began to blow at that rate, the time of the highest velocity and the time it ended. Such data as these are often used as evidence in courts where damage has been occasioned by high winds.

The direction from which the wind is blowing is registered by the anemoscope or wind vane. (See Fig. 2.) It consists of an iron rod with spreading tail of wood and so balanced that it is easily turned by the wind as it changes direction. The vane is securely fastened to another rod running vertically to a contact box. The entire weight of the vane is supported upon three anti-friction rollers. Within the contact box are the devices for securing electrical registration. They consist of projections or "cams" attached to the lower end of the vertical rod, so arranged, that in whichever direction the vane may be pointing at each minute interval that the circuit is closed by an automatic attachment connected with the clock of the register, a dot is made upon the registering sheet. These dots, in the rela-

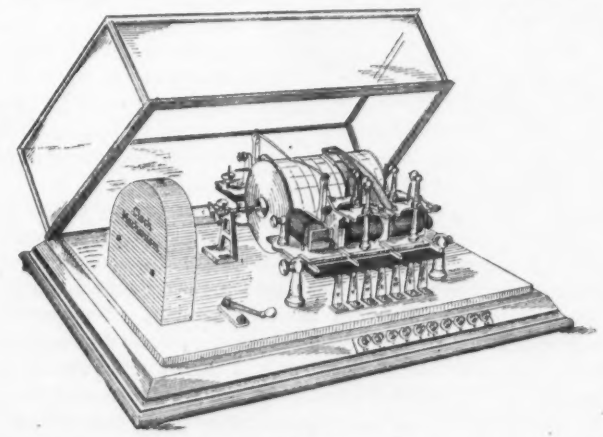


FIG. 3.—METROGRAPH.

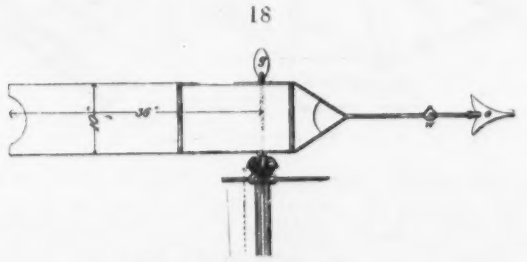


FIG. 2—ANEMOSCOPE.

tive way in which they mark on the sheet, represent either north, northeast, east, etc., recording to the eight principal points of the compass. If the direction of the wind at the minute of contact is from the north, then the north contact is closed in the contact box, and the current passes through the north magnet of the register, which causes the point of the armature to record on the sheet. These data are tabulated and entered on a monthly sheet, showing the average direction from which the wind blew for each hour of the day and the prevailing direction for the month. The number of miles and the length of time that the wind blew from each direction are also tabulated.

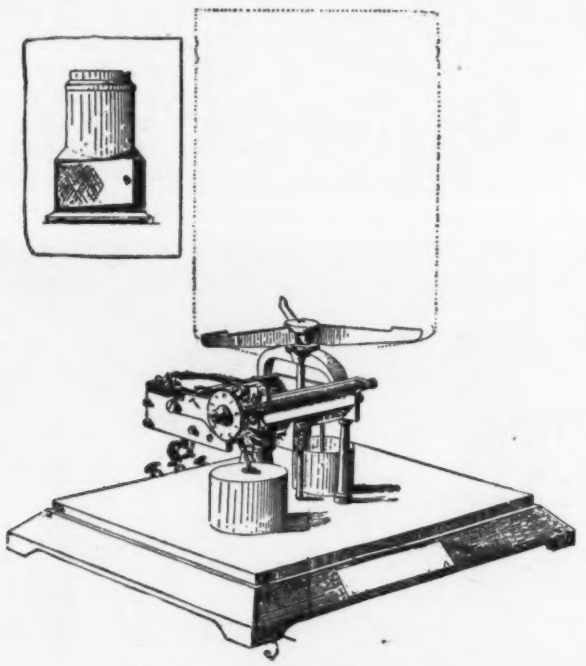


Fig. 4.—Rain and Snow Gauge.

The automatic records of the sunshine recorder, the anemometer and the wind vane, are registered on one instrument, which is called a metrograph or improved triple register. (See Fig. 3.) The instrument has three essential parts, the drum or cylinder, the clock and the electromagnets. The drum is a brass cylinder, upon which at noon each day a sheet, ruled off into hour and minute spaces, is placed. The cylinder is connected with the clock by means of an ordinary thumbscrew and is turned in exact accordance with the time, making four revolutions in the 24 hours. The marks indicating the miles of wind are made at right angles to the direction of the revo-

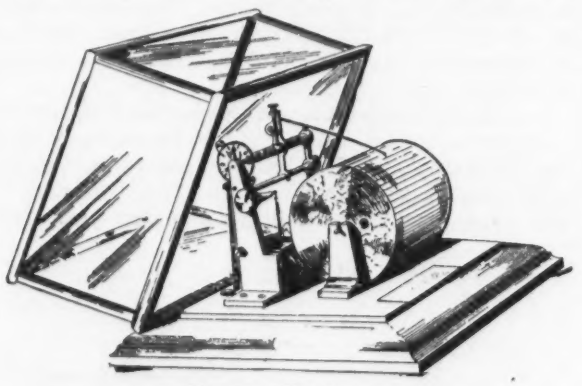


Fig. 5.—Register.

lution of the cylinder, and the number of marks within a five-minute space show the rate per hour at which the wind is blowing. The magnets actuate the pens or armatures when the electric circuit is closed. The self-inking pens rest very lightly upon the ruled sheet, the wind-velocity pen marking to the left and the sunshine pen to the right. The wind direction is recorded by four type hammers, each attached to an armature and resting upon an inked pad.

Richard's electric thermograph, more commonly called the telethermograph, is the instrument which electrically records the outside temperature. The instrument consists of two parts, the thermometer and the register. The thermometer has an alcoholic bulb, which expands or contracts as the temperature rises or falls, and this motion is many times magnified, and transmitted to a pointer or index by means of a system of levers. Whenever the temperature rises or falls, the motion is carried to the index, a contact is made and the electric current passed through one of the magnets of the register, which causes the tracing pen of the register either to rise or fall in exact accordance with the movement of the index. The cylinder is like that of the triple register already described, and is turned by an ordinary clockwork attachment, the sheet being ruled into hour spaces and placed upon the cylinder. The temperature data from this sheet are tabulated and entered on a monthly sheet for each hour of the day, and from this the mean average temperature for the month is obtained.

The weighing rain or snow gauge, invented by Prof. Marvin, who is in charge of the instrument room of the Bureau, has two parts, the gauge (see Fig. 4), and the register (see Fig. 5). The gauge consists of a receiver, set upon a scale mechanism, evenly balanced by weights. When rain falls, the weight increases and this causes an electric contact to be made for every thousandth of an inch and this is transmitted to the tracing pen by means of the current passing through a magnet in the register ; so that the pen is moved in accordance with the increase in weight for each $\frac{1}{1000}$ of an inch. The pen works on an endless screw and moves back and forth across the sheet. From this sheet a record is obtained of the exact time that rain began and ended and also of the times of excessive falls of rain.

Electric Railway Management.

In a paper read at the recent convention of the Pennsylvania Street Railway Association, at Wilkes Barre, Mr. A. K. Baylor states that direct connection of engines and generators has in most cases everything in its favor, and where land is high and rents large, these two points alone will dictate the choice of this type of unit. Experience has shown that the great fluctuation of load inevitable in railway work is a negligible factor with respect to serious strains on direct connected units where a properly proportioned fly-wheel is introduced between the engine and the armature. As to the proper division of units, generally speaking, perhaps the best plan is the installation of three units of equal size, two of which are capable of carrying the full load. This permits economical running, both at half load and full load, and leaves one unit always in reserve. Some roads, however, have made a division of power into, say, two large units, equal to one-half the full load, and one small unit, equal to one-quarter of the load, thus practically permitting full load to be maintained all the time. The combinations of these machines will give one quarter, one half, three quarters and full load, but in case one of the large units gives out, the remaining units will have to be considerably overloaded to handle the full load of the station.

The paper recommended that buyers should confine their specifications to general considerations, leaving the details with the manufacturers; otherwise, by insisting on some peculiarity of detail, the machine delivered may be inferior to what it would have been had the manufacturer been allowed greater liberty with respect to design and then held accountable for results.

It is pointed out that, besides the saving in series parallel over rheostatic control, which amounts to from 25 per cent. to 40 per cent., the size of the generating plant with the former is less and the effect of momentary variations in load reduced; not only is there greater economy, but the momentary fluctuations in load to be taken care of are much less violent. Another practical advantage is in the possibility of running all the cars at half speed in case of derangement to half the power-house capacity.

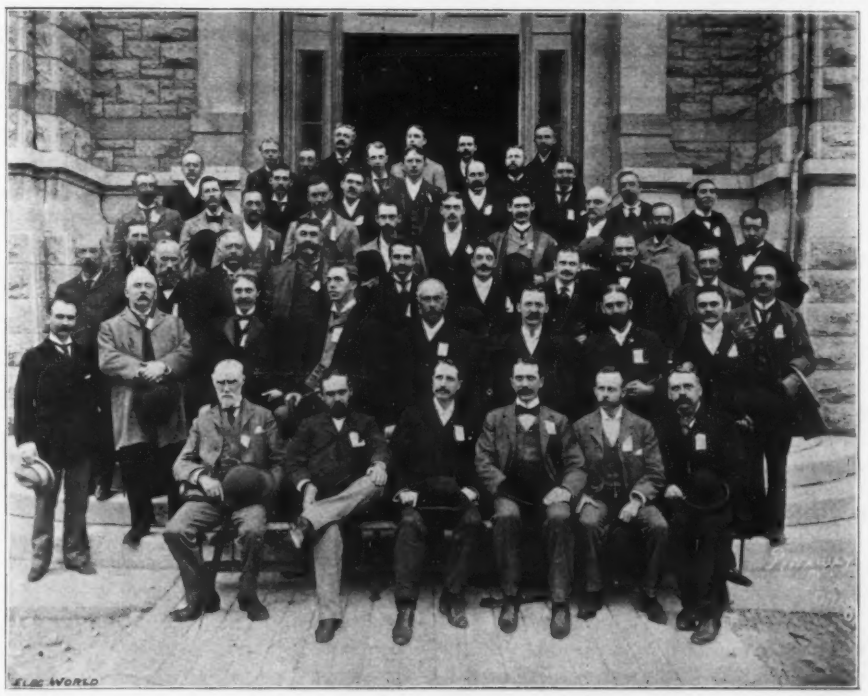
The use of recording wattmeters in power houses is advocated. By their means load curves may be established, representing fairly the power consumed to handle a given traffic, thus enabling a careful and intelligent comparison to be drawn between different days and seasons, and between days of similar character. Wattmeter readings on motor cars are of special importance, establishing as they do for the unit what the station readings show for the whole system.

The lack of instruction which many motormen receive is deprecated. It is advised that they be instructed in the car circuits, with a diagram showing the connections at each position of the controller; a plan commended is that of posting on car barns and in employees' rooms as a graphic object lesson, a chart of curves laid upon one plot, comparing the fluctuations in current with the right and wrong methods of starting. A valuable aid also in the education of motormen is the use of the voltmeter on cars in plain sight, so that during the running the man can see the fluctuations of the instrument and note the results of incorrect handling as compared with the right method.

THE fifth annual convention of the Canadian Electrical Association was opened at the city of Ottawa, on Sept. 17, under the most auspicious circumstances. Ottawa is a decidedly appropriate place for the holding of this gathering. A visit to the national capital is always of interest to every one, and the particular beauty of the government buildings adds more than ordinary interest. Moreover, the city, with its crown of towers, its Chaudière and Rideau Falls supplying an abundance of motive power, may hold up an honored head amongst other Canadian and American cities. In the matter of electrical development, also, it has the proud claim of being further advanced than many cities of much greater size. The central-station man may learn much at the different power stations of the Ottawa Electric Company, where problems of an unusual character have entered into consideration, and where all machinery is driven by water power. The railway man can see, perhaps, the best example of electric railway work to be met with in this country, and even the telephone and telegraph men can find much of interest here.

The preparations for the meeting have been very complete. A number of papers of unusual interest, in a practical way, and others of more scientific import have been prepared. The social features have been left with the Ottawa members of the executive, who have been very energetic and untiring in their efforts to prepare a pleasant visit for the fraternity.

The predictions of Prof. Wiggins that an equinoctial storm of exceptional severity would sweep over the country during this week have been the subject of a somewhat humorous discussion among the members, but have been considered as not a sufficient reason to postpone the meeting, and they evidently have not decreased the attendance, which was even better if anything than that at the Montreal meeting last year. The Association shows a very healthy growth in point of membership as well as in other respects. Most of the members have become well acquainted with each other by this time, and look forward to these annual gatherings with considerable pleasure. Others who did not join the Association at its inception have come to realize the benefit of such an organization, and the membership roll is swelling rapidly.



GROUP OF DELEGATES.

The Toronto and Western delegates came over on the Canadian Pacific night train, having had a special Pullman assigned for their use, while the Eastern and Montreal contingent arrived shortly after noon. The headquarters of the convention were at the spacious Russell House.

FIRST DAY.

Promptly at 11 o'clock the convention was formally opened, in the railway committee room of the House of Commons, when His Worship, Mayor Borthwick, delivered an appropriate address of welcome, in which he spoke of the wonderful changes which had been wrought by the application of electricity. The address was suitably replied to by President Dunstan, after which an inspection of the spacious Parliament buildings and grounds were made, under the guidance of the sergeant-at-arms. From the high elevation at this point an excellent view is obtained of the Chaudière Falls and its milling and manufacturing surroundings. On the other side of the river is also seen the city of Hull and the outlying smaller hamlets along the banks of the river.

The first business meeting was convened in the board room of the Board of Trade. The attendance was a very encouraging one for the first meeting, nearly all the members who attended the convention being present.

President K. J. Dunstan then opened the proceedings with an address in which he dwelt upon the growing prosperity of the Association, and gave a review of electrical progress throughout Canada during the past year. He referred to the fact that the severe depression in trade, and great stringency in money experienced during the past few years had borne less severely upon those engaged in electrical industries than in any other branches of trade or commerce. The great development of electric railways in the Dominion was commented upon, and details given of the Hamilton, Grimsby & Beansville Railway, 18 miles long, which is the most important road opened for traffic in Canada during the past year; during the three months of June, July and August, it was stated that 97,164 passengers were carried and 559 tons of freight handled, in addition to 2,917 cans of milk and a large quantity of fruit; one result of the building of the road has been to establish Hamilton as the headquarters of a great fruit trade. Mr. Dunstan expressed his opinion that in a country such as Canada, where there are so many opportunities of obtaining water power from natural falls or from damming the surplus water of rivers and streams, the conditions for the development of electrical transmission plants are peculiarly favorable. Reference was made to the recent attempt to establish a municipal plant in Toronto, which was defeated by a vote of 8 to 1. The effect of competition from the Welsbach light was commented upon and fears from this cause declared to be groundless. Electric lighting men, however, it was added, must face the fact that prices, from competition or other causes, have a downward tendency, which must be met by improved methods of production and the maintenance of a high standard of efficiency, both of which require the exercise of skillful business management, combined with technical knowledge and a thorough grasp of details.

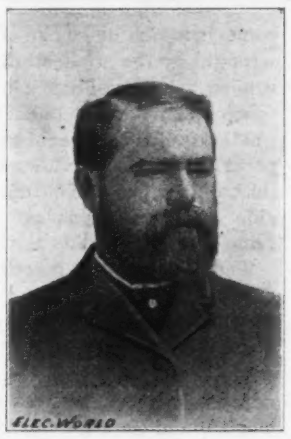
Then followed the reading of the minutes of the last meeting and the report of the treasurer, which showed the Association to be in a very flourishing condition. There are now on the rolls 169 active

and 42 associate members, a gain of 71 over last year's membership; the balance in cash on hand is $375.

After the report of the treasurer had been discussed and adopted, the reports of standing committees were taken up. The report of the committee on the revision of the constitution was handed in by the chairman, Mr. Kammerer, and laid over until Wednesday forenoon for consideration.

Mr. Breithaupt, the chairman, reported for the committee on statistics that it had been found that the collection of data concerning central stations, such as cost of operation, amount of output, prices

K. J. Dunstan,
Retiring President.



A. B. Smith,
President-Elect.

realized, etc., would involve the expenditure of a very large amount of money, since most central-station men were not inclined to answer the circular forms which might be sent out, and that the work had therefore not been proceeded with in that way. The Dominion Government has, however, within the past year undertaken the compilation of statistics relating to electrical industries, and on their suggestion the committee co-operated with the Dominion statistician in this work. The committee has gotten up detailed forms which the government is now sending out, and although the answer received from each separate company will be kept private, to a certain extent a large amount of data and the totals compiled from these returns will be published and will be of much value, particularly so because they will be completed. The report was also laid over for consideration.

The committee on legislation reported, among other things, that during the last session of the Ontario Legislature a bill had been introduced which, if it had become law, would most assuredly have worked an injustice to many, and would have become burdensome to all who had invested their capital in electrical enterprises, by laying a tax as personalties upon all street poles, wires and other equipments of electrical companies. A circular was sent out to the different members of the Association, requesting them to use every influence to defeat this bill, and the inadvisability of such a law was so forcibly impressed upon the minds of the members of the legislature that the bill was withdrawn by the mover.

A committee of this kind to look after and watch what may come up from time to time for consideration in the Dominion parliament, as well as in the provincial legislatures, is no doubt a good idea upon the part of the executive of the Association, and will result in benefiting the electrical fraternity. Measures are often introduced in the legislature, no doubt with the best of motives, but whose full trend and operation is probably not understood by the movers, and it is in this way that the Association can point out the probable results.

Mr. A. A. Dion next presented his paper on "Some Notes on the Consolidation of Different Systems of Electric Supply."

The paper of Mr. Dion describes at length the plans adopted for consolidating the three electric lighting plants of Ottawa, which have recently come under the same management. The problem was that of consolidating conflicting elements to form a single and uniform system, and without throwing any of the apparatus out of service. An account of these several plants, including the main points of Mr. Dion's paper, will be found in our last issue.

The discussion was opened by Mr. E. Carl Breithaupt and Mr. J. J. Wright, who commented at some length on the particular points of difficulty met with and on the results which might be obtained from the system of dynamo excitation and regulation which is being employed. Mr. Fisk, of Peterboro, who has had considerable experience also with water-power plants, both in lighting and railway work, gave some account of his experiences with the regulation of water wheels, and particularly of the trouble caused by anchor ice. An animated discussion of the anchor ice difficulties followed, in which Mr. McFarlane, of Montreal, Mr. Dion, Mr. Powell and others took part. Mr. Powell, who is a member of the board of directors of the Ottawa Electric Company, and was formerly manager of the old Standard Company, stated that the principal period of trouble was late in the Fall when the water had cooled to the freezing point, and on account of its rapid flow over shallow places a crust had not yet been formed, and again in Spring after the Winter ice had broken. At such times a sort of snow formed in front of the opening of the wheels and effectually blocked them. A number of different remedies have been tried, but the difficulty is found to be a very serious one.

Mr. Chas. P. Dwight then presented his paper on the early history of the telegraphs in Canada. This paper is of special interest as forming one of a series of historical papers which this Association is compiling. The early history of the telephone and of electric railway work in this country have already been written about and discussed at former meetings, and are on file in the archives of the Association.

Mr. Dwight's paper was a very comprehensive one, and showed that in telegraph work, as well as in the other branches of applied electricity, the first capital expended reaped very small pecuniary reward. The paper was discussed by a number of old-time telegraphers. Mr. Black gave some more details about the construction of the Grand Trunk telegraph line, stating that the poles instead of being properly planted were simply set in small holes dug with augers, and that the wire used was a steel wire. Mr. Higman, in speaking of the way telegraph lines were operated before the exact measuring instruments of the present day were in use, related the story of a line which had once been broken in several places by a severe storm. The construction men, after having used up all their wire in repairing breaks they had met with so far, found they still required several yards to cover the last gap. This they finally accomplished with several lengths of old stovepipe, which they managed to obtain at a neighboring farmhouse, and it is related that the line worked satisfactorily for several weeks afterward. Mr. W. Y. Soper and Mr. A. B. Smith also commented on the paper.

This concluded the business programme of the day. In the evening the delegates were conveyed on special electric cars to the Chaudière, and shown the Falls, the numerous sawmills, one of which they inspected while it was in operation; the several power houses of the Ottawa Electric Company and the Ottawa Electric Railway

C. Berkeley Powell,
1st Vice-President.

L. B. McFarlane,
2d Vice-President.

Company were also visited, and elicited much favorable comment. Mr. W. Y. Soper and Mr. C. Berkeley Powell, of the local committee, were in charge of the party. A very enjoyable and profitable evening was spent by all present.

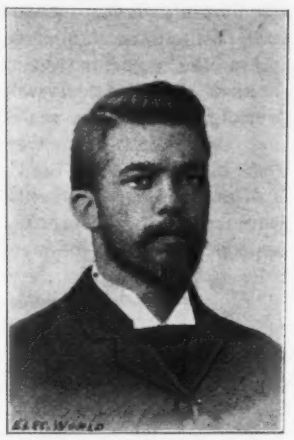
SECOND DAY.

On the second day of the convention the delegates were again favored with clear September weather, and the attendance and interest displayed in the meetings was even larger than the day before. As the mayor of the city had very kindly placed the City Hall at the

disposal of the Association for its sessions, and as the Board of Trade room had been found a little small to accommodate yesterday's meeting, the offer of the mayor was accepted, and the meeting was called to order in the spacious Council chambers of the City Hall promptly at 10 o'clock.

The forenoon was entirely taken up by routine business. The report of the committee on legislation was taken up for consideration, and after some discussion it was adopted. The revised constitution, as presented by the committee at the previous session, was lengthily discussed and after some minor changes was also accepted.

C. H. MORTIMER,
Secretary.



E. CARL BREITHAUPT,
Mem. Exc. Committee.

The report of the committee on statistics was also considered and accepted.

The next business in hand was the selection of the place and time of the next meeting. As a large number of the members are Western men, and since the last two conventions have been held in the East, it was considered advisable to meet next year in the city of Toronto. Some discussion ensued as to the time of meeting. Many members claimed that the latter part of September was not a favorable time for such a gathering, since most of the men engaged in these industries have by that time gotten over their holiday mood, and are settling down to hard work. Moreover, it is just at the time when any work, particularly outside work, which has to be done before Winter sets in, must be taken in hand. It was, therefore, decided that the session should be called to meet some time during the month of June. The election of officers was next proceeded with. Mr. A. B. Smith, superintendent of construction for the Great Northwestern Telegraph Company, was unanimously chosen president for the ensuing year. Mr. Smith was one of the original members of the Association; he has been a member of the executive since its organization, and has always taken a very active interest, and displayed untiring zeal in the promotion of the welfare of the fraternity, and, therefore, well deserves the honor conferred upon him.

Mr. C. Berkeley Powell, of Ottawa, who has long been intimately connected with the electrical concerns of Ottawa, was chosen first vice-president, and Mr. L. B. McFarlane, the eastern district manager for the Bell Telephone Company, was elected second vice-president. The Association made a very wise selection in the appointment of these gentlemen, and its interests will be well looked after in their hands.

According to the new constitution a somewhat novel method of selecting the executive committee now exists. This committee consists of ten members, and in order that the composition of this body may not be radically changed each year, five members of the committee which served during the past year are re-elected to serve for another year. After these have been elected, five more members are ballotted for to make up the balance of the committee, and in this latter ballot all active members of the Association, whether they have served on the committee during the previous year or not, are eligible for election. In this way any disadvantages which might arise from appointing members at once for two consecutive years is also avoided. Of the present committee Messrs. William Black, of Hamilton; J. J. Wright, of Toronto; O. Higman, of Ottawa; J. A. Kammerer, of Toronto, and E. Carl Breithaupt, of Berlin, were appointed to serve the second year. The five new members are Messrs. John Carroll, of Montreal; F. A. Badger, of Quebec; A. M. Wickens and K. J. Dunstan, of Toronto, and W. Y. Soper, of Ottawa.

After luncheon the delegates were photographed on the steps of the City Hall, and on the reopening of the business meeting a further criticism on Mr. Dion's paper, which had been communicated by letter by Mr. D. H. Keeley, who unfortunately could not attend, was read.

Mr. Keeley spoke of the method of separate excitation described in Mr. Dion's paper, and thought that in a case where a number of different dynamos, alternating or direct, were excited from the same machine, there might still be some fluctuation in the magnetization of the field coils, due to the sudden introduction or withdrawal of part of the load; but if the turbine is so governed that it will maintain the given speed, irrespective of the demands made upon it, changes could perhaps take place so rapidly as to be almost imperceptible. This feature, taken in conjunction with the supplementary regulators or "boosters" whereby the drop in leads to the increased current may be made up, would simplify the matter of current supply. These considerations bring out prominently what is the great considerations of the hour—the thing needful to the attainment of perfection—an automatic booster, pure and simple.

The first paper of the afternoon was that of Mr. Milne, "From the Coal Pile to the Meter."

Mr. Milne's paper is based upon diagrams calculated from different sources. One diagram illustrates the amount of coal required to keep up the pressure in certain boilers, which, when the fires were banked, amounted to 100 pounds per hour for two boilers, and 210 pounds per hour when steam was turned on the main steam pipe. The following is a recapitulation of the results arrived at:

Power for running generators	100	Per Cent.
Power available at switchboard	92	"
Power available at meter	78.20	"
Engine	100	"
Available for generating current	83.3	"
Available at switchboard	75.72	"
Available at meter	64.35	"
Boiler equivalent	100	per cent.
Indicated hp at engines	7.04	"
Available for generating current	5.79	"
Available at switchboard	5.33	"
Available at meters	4.53	"
Coal pile equivalent	100	per cent
Available at stop valves of boiler	62.47	"
Indicated hp at engine	4.4	"
Available for generating current	3.62	"
Available at switchboard	3.33	"
Available at meter	2.83	"

Final efficiency, 2.83 per cent.

This paper was commented on by Mr. E. Carl Breithaupt, who called attention to the fact that the data from which the results

T. R. ROSEBRUGH.

H. T. HARTMAN.

shown were compiled, were gathered at a station where high-speed non-condensing engines are in use. It would be instructive to compare the results here obtained, with similar ones from a well appointed condensing plant. The relative figures could be arrived at fairly close by deduction, by introducing the deficiency of figures obtained for the engine plant of the condensing station in place of those stated for the engines by Mr. Milne.

The last paper of the day was one relating more to the office end of central-station work, entitled "Suggested Forms in Electric Light Accounting," and presented by Mr. D. R. Street.

The paper of Mr. Street describes the various accounting forms used by the Ottawa Electric Company, which are the result of varied experiments and comparisons with other systems. They number 31 in all, and are classified under the following heads: Applications and contracts for the supply of light and power (4); supply requisitions and orders (3); orders for construction and repair work (4); time returns and pay rolls (3); lamp records (4); collection of revenue (10); general books (3).

The paper was discussed at some length by a number of the members. Mr. Armstrong thought that the forms presented by Mr. Street though of undoubted value to the larger companies, would prove somewhat cumbersome in smaller places, and asked if any suggestions to meet such cases could be made. Mr. A. A. Wright, of Renfrew, gave a short account of the system of accounting which he uses.

As this concluded the business of the second day an adjournment was at once taken to enable the members to avail themselves of the generous offer of his excellency the governor general, who had placed his electric launch at the disposal of the Association during their meeting. The governor general's launch is a most perfectly appointed boat, and the members who accompanied Mr. Higman on a short excursion down the river were well repaid for the few hours spent in this wise.

BANQUET.

The banquet given on Wednesday evening in the Russell House to the convention members and the ladies accompanying them was pronounced by all as one of the most brilliant affairs ever held at

THE BADGE.

the capital. The decorations of the large dining hall were so complete as to excite even the surprise and wonder of long experienced electrical men. Something over 800 incandescent lamps were distributed throughout the hall, forming beautiful mottoes and long festoons. At the south end of the hall was the word "Ottawa" in large letters, while at the opposite the figures "1895" were visible. On one side, bordered by a large group of national flags, was the Union Jack, produced by red, white and blue incandescent lamps, and on the opposite side the monogram, "C. E. A.," surrounded by an immense horseshoe and banked also amongst flags, was illuminated by various colored lamps, while further up was the beaver and maple leaf, the badge of the Association, outlined also by colored incandescents. The chairs occupied by the lady guests were handsomely decorated with evergreens, topped with colored lights, and the whole walls and ceilings were profusely bedecked with bunting and evergreen streamers. The meats were carved on a raised platform at one end of the hall in full view of all the assembled guests. A very novel and pleasing effect was produced by connecting the carving utensils to the opposite terminals of a light lead, so that whenever they were brought in contact sparking would be produced. In the centre of the dining room stood a rotating crystal pyramid composed of a multitude of mirrors and varied colored lamps, the whole surrounded by beds of foliage. The pyramid was constantly rotated, and was the admiration of all present. Each of the tables was embellished with artistic creations in pastry, among which were the representation of a four-pole railway generator, complete to the smallest detail; the outside equipment of the telegraph service; a large insulator and a perfect miniature electric car, street railway controller and a telephone receiver. This receiver might be said to have been of an heroic size, and was the occasion for much merriment, owing to the immense size of the hall, the speakers not being distinctly heard at opposite ends of the rom. This receiver was made use of in this connection.

Among the guests were numbered many of the most eminent residents of the capital, as well as a large concourse of ladies. At the president's right were seated Mayor Borthwick and Mr. Joseph Kavenagh, while on his left were Sir James Grant, M. P., and Mr. H. P. Dwight, president of the Great Northwest Telegraph Company.

A handsome menu had been prepared, and the delicacies provided were of the highest order. The various items were couched in appropriate terms, the menu card being as follows:

"O hour of all hours the most blessed upon earth,
Blessed hour of our dinners!"

MENU.

Clear Dynamo Soup with Dumpling Units.

Broiled White Fish with Ampere Sauce.
Sliced Cucumber and Grounded Potatoes.

Lamb Cutlets and Green Peas.
Chicken Soufflee, Dunstan Style.
Filets of Beef, Street Railway Sauce.

Roast Ribs of Beef, Ottawa Style.
Boiled Turkey, Polyphase Sauce.

Anchor Ice Sherbet.

"The game is up; every man to his taste."
Black Head Duck with Direct Current Jelly.
Lettuce Salad, Telephone Dressing.

English Plum Pudding with (low potential) Brandy Sauce.
Greengage Tart. Wine Jelly.
Electric Ice Cream.
Cream Meringue. Fancy Cakes.

Fruits.
Cheese and Crackers. Coffee.
Sherry (Wattage of '95). Ale. Ginger Beer.
Ginger Ale.
Electrocution.

The list of toasts on the menu card was prefaced and concluded with the following appropriate sentiments:

"Let me speak, sir,
For heaven now bids me; and the words I utter
Let none think flattery."

"We part—no matter how we part;
There are some thoughts we utter not;
Deep treasured in our inmost heart
Never revealed and ne'er forgot."

A toast, "The City of Ottawa," was responded to very ably by Mayor Borthwick and Sir James Grant, who spoke wittily and in loud terms of praise for the men who had been instrumental in the advancement of electrical science, both in Ottawa and elsewhere. He congratulated Ottawa in having a local Edison in the person of Mr. T. Ahearn, who by his innate genius had done so much toward the development of electricity as to make his name honored both in Ottawa and abroad. The toast, "Our Guests," was suitably responded to by Mr. Geo. Johnson, the Dominion statistician. The health of Mr. H. P. Dwight, president of the G. N. W. Telegraph Company, was then proposed by the president, and was responded to in a very feeling manner by that gentleman, who in his reply jokingly protested against the "old boys" being jostled aside by the young members of the fraternity, but said that the thought was comforting that the older men were the pioneers in developing probably the most beneficial of all modern sciences. The toast to "The Press," was responded to by Editor Shannon, of the Ottawa *Citizen*, and by Mr. Cook. Mr. W. Y. Soper very gallantly and ably responded to the toast, "The Ladies."

"Auld Lang Syne" and "God Save the Queen" were then sung, and the gathering was dispersed.

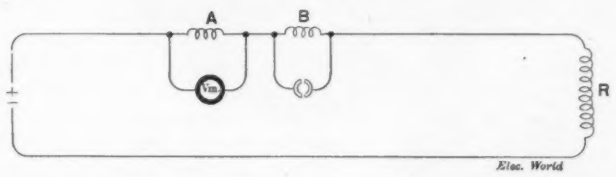
The visiting delegates and other guests are under a great obligation to the committee of arrangements, and also to the different electrical concerns of Ottawa who contributed largely in the financial way toward the expenses of this magnificent spectacle for the splendid evening which they enjoyed, and all present left the banquet hall with the conviction that, while the electrical men of Ottawa are among the most able men technically, as well as financially, which Canada has produced, they are also among the most warm-hearted and hospitable.

THIRD DAY.

The convention was called to order by President Dunstan promptly at 10 o'clock with a good attendance, though some few stragglers were of the opinion that an automatic booster on the lines as sug gested yesterday by Mr. Keeley would be a good thing to have just at this time.

Mr. Keeley's two papers, the first, "A Non-Interference Diplex Relay," the second, "A Percentage Method for Circuit Measurements," were read by Mr. J. J. Wright in the author's absence, and were discussed and commented on by Mr. Kammerer and others.

The first of Mr. Keeley's papers describes a diplex relay, designed to obviate interference between the sides of a quadruplex system when both are actuated at the moment of current reversal in the polar system, or at the moment of transition from extremes of current strength, in the straight system. The second paper describes a method enabling one to make measurements of any electrical circuit, by means of either a voltmeter of low range or an ammeter, and adapted for both direct and alternating currents. In the accompanying diagram, A and B are two known resistances included in



the circuit to be tested, and V is a voltmeter, shunted about A. By measuring the voltage of A with B in circuit and then out of circuit, the percentage which B bears to the entire resistance is obtained, and, therefore, the entire resistance of the complete circuit accurately determined.

Next followed the paper by Mr. H. T. Hartman, on "Some Modern Alternating-Current Apparatus."

Mr. Hartman, after reviewing the methods of distribution used with continuous currents, takes up the alternating-current system, and names several faults with respect to distribution which have gradually become painfully evident in its operation, as follows: First, the loss from the centre of distribution to the lamp on the consumer's premises is from 3 to 5 per cent. greater than with direct-currents, on account of the drop in transformer, resulting in bad regulation at the lamps and in a reduction of their life; second, a transformer has to be installed for practically every consumer, and the central station is thus compelled to have a considerably greater transformer capacity than lights installed, while the low all-day efficiency of the transformers causes a wasteful drain on the station. These evils, he says, have been remedied by using modern transformers giving less loss at no load and full load; by putting more copper in the street lines and distributing it to better advantage; by using alternators properly compounded, and the employment of the three-wire system of secondary distribution. This latter is pronounced to have the very great advantage of lessening the number of transformers, permitting the use of large units which are more efficient at all loads, and the carrying of a greater average load than under the old method. The third fault referred to is that of inductional troubles, a subject which, Mr. Hartman says, has been enveloped in such an air of mystery that the average station man is apt to think there is no use in attempting to understand it. It is stated that these troubles may be reduced by using a smaller number of alternations, by placing the two lines of each circuit as closely together as possible, and as far from any other circuit as possible, and by crossing the lines of two circuits at the middle of their length, thus causing the effect in one half to be counteracted by the effect in the other half.

The effect of self-inductance is said to "vastly increase the loss in a line, and consequently interfere seriously with regulation if present in a lighting circuit. (It may be here remarked that inductional drop in itself does not involve any loss of energy.)

Mr. Hartman says that the two and three-phase alternating systems are subject to a serious disadvantage, in that the circuits must be kept balanced; otherwise one armature circuit is liable to be overloaded, and as any adjustment of the field to give proper voltage on that circuit will give very different results on the others, the regulation is bad. The question of balancing the circuits is declared to be far worse than in the case of an Edison three-wire plant, for in that case three wires are run to every installation of over six lights, but in the case of the polyphase circuit one is practically limited to balancing one transformer against another, and the shutting down of a few transformers on one side of the system makes a serious difference of potential. The monocyclic system is described at length, and is stated to possess all the advantages of the polyphase system combined with the simplicity of the single-phase, and not to be subject to the disadvantage due to lack of balance.

A very lively discussion followed. Mr. Medbury took exception to some of the statements made. He was of the opinion that the direct-current two-wire system was not an advisable one, except in case of where the area to be covered was a very limited one, such, for instance, as is usually met with in an isolated plant, and also objected to comparisons being made between the distribution on the three wire system in alternating and direct current work, claiming that these are not parallel cases. He spoke at some length about three-wire distribution in the secondaries of an alternating line, and thought that the method could be improved upon.

Mr. W. B. Jackson also spoke at some length and differed from the author on a number of points, principally in the statement that two-phase systems cannot be kept properly balanced; he also took exception to the parallel drawn between an Edison three-wire plant and alternating three-wire distribution.

Mr. F. C. Armstrong took up the arguments advanced in defense of the author's claim.

The following gentlemen were then nominated and elected:

Committee on statistics, Messrs. E. Carl Breithaupt, John Yule and O. Higman; committee on legislation, Messrs. J. J. Wright, K. J. Dunstan, C. Berkeley Powell, L. B. McFarlane, F. A. Badgley.

Votes of thanks were proposed to the local committee, particularly to Messrs. Powell and Soper, for the very complete arrangements they effected for this meeting, and the excellent entertainment they provided. The hearty thanks of the Association were also tendered his excellency the governor general, the Ottawa Railway Company, the Board of Trade, the city authorities, the press, and others who had been instrumental by their generosity in making the meeting such an unqualified success. The hearty thanks of the Association and appreciation for the energy and interest he has always taken in the welfare of the Association, was also tendered the retiring president, Mr. Dunstan, after which the meeting adjourned.

In the afternoon the members were taken for a trip over the city by the courtesy of the Street Railway Company.

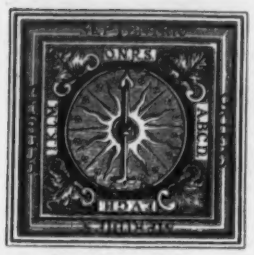
This concluded the fifth and in all respects the most successful gathering which the Association has thus far held, and the members left for their respective homes with the feeling that their attendance had not been a waste of time, but, on the contrary, each carried with him the conviction that the Association and friendly meeting of others in the same field of work had been of much practical benefit to himself.

THE ATTENDANCE.

Anderson, R., Ottawa.
Armstrong, F. C., Toronto.
Atkinson, F. W., Montreal.
Badger, F. A., Quebec.
Baylis, James A., Toronto.
Bigger, E. B., Toronto.
Black, George, Hamilton.
Bonner, W. T., Montreal.
Borthwick, W., mayor, Ottawa.
Bott, H., Ottawa.
Breithaupt, E. Carl, Berlin.
Brown, J. E., Aylmer.
Burnett, James A., Montreal.
Carroll, John, Montreal.
Coleman, V. B., Port Hope.
Dale, John H., New York.
Dewar, D. C., Ottawa.
Dion, A. A., Ottawa.
Dryden, J. F., Toronto.
Dunstan, K. J., Toronto.
Dwight, Chas. P., Toronto.
Dwight, H. P., Toronto.
Edwards, H. O., Montreal.
Fisk, H. O., Peterboro.
Gilmour, W. J., Brockville.
Gordon, J. C., Toronto.
Harrington, F. W., New York.
Higman, O., Ottawa.
Jackson, W. D., Pittsfield, Mass.
Kammerer, J. A., Toronto.
Knapman, J. S., Peterboro.
McCrossan, J. A., Rat Portage.
McFarlane, F. B., Montreal.
McKay, W. A., Renfrew.
McLaren, D. W., Montreal.
McLaughlin, W. R., of the ELECTRICAL WORLD staff, New York.
MacDonald, G. F., Ottawa.
Mann, F. C., Toronto.
Medbury, Chas. F., Ottawa.
Moles, R. G., Arnprior.
Mortimer, C. H., Toronto.
Murphy, John, Ottawa.
Powell, C. Berkeley, Ottawa.
Roche, C. H., Ottawa.
Routh, C., Ottawa.
Shaw, D. A., Montreal.
Simpson, A. F., Sherbrooke.
Smith, A. B., Toronto.
Soper, Warren Y., Ottawa.
Street, D. R., Ottawa.
Taylor, J. W., Ottawa.
Thompson, J. H., Ottawa.
Thompson, F., Montreal.
Wickens, A. M., Toronto.
Wise, J. F. H., Pittsfield, Mass.
Wright, A. A., Renfrew.
Wright, C. H., Renfrew.
Wright, James, Toronto.
Wright, J. J., Toronto.

The Invention of the Electromagnetic Telegraph—V.*

BY A. M. TANNER.



N July 3, 1837, Dr. Dujardin, of Lille, deposited a sealed package containing a description of a new telegraph system by means of electricity transmitted by long metallic conductors. The description, however, which never was published, could not have referred to an electromagnetic telegraph, because the same inventor, in a published description in the *Comptes Rendus* for 1846, says that he substitutes for the Morse soft iron armature a magnetized steel armature, and passes reversed currents through the electromagnet. Dujardin in this article says that the use of the electromagnet and soft iron armature is due to Morse.

Another inventor of an electromagnetic telegraph, devised in 1837, appears to have been Amyot, as we find that on Dec. 26, 1837, he deposited a sealed package with the Academy of Sciences, containing a description of a method of corresponding telegraphically by means of electricity.

This package, as well as the earlier one deposited by Dujardin, were submitted to a commission composed of Antoine Cesar Becquerel[3] and Felix Savary. It does not appear, however, that they ever reported on the merits of the respective inventions, and they must be considered as mere communications which have remained forever in the secret archives of the Academy of Sciences. We find, however, that Amyot, on July 9, 1838, addressed a communication to the Academy of Sciences, which was inspired by a description of the Morse telegraph, seen by him in the *Annals of Electricity*, for May, 1838. Amyot in this communication refers to electric telegraph schemes proposed by Ampere[4], Berton, Reiser, Salva and Schilling, and then goes on to describe his own system in the following words:

"As far as I am concerned, after having studied the questions as far as possible, I have resolved upon the use of a single current of electricity, and of a single needle, which itself writes on the paper with mathematical precision, the correspondence transmitted at the other extremity by a simple wheel, on which the writing is executed by means of points differently spaced, as in the wheels of ordinary hand organs. This wheel turns regularly by means of a clock spring, and in this manner it is only necessary to write in a kind of movable characters the news to be transmitted. This kind of dispatch is put into a box, and at the same instant it is written by itself at any distance to which it may be sent, and the agents awaiting the same have only to collect the paper, which is moved regularly by the machine, and the dispatch can be understood by those who know how to read the cipher.

"By this mode no error need be feared, as everything moves like clockwork. So far as the conducting wires are concerned, it is sufficient to guard them from oxidation, either by placing them in the ground and coating them by a simple varnish."

AMPERE.

It is evident that this description of Amyot has reference to a recording telegraph making use of a single circuit and a single needle bearing the marking point. The employment of the expression "needle" indicates, however, that it was an instrument of the Steinheil type, in which the marking needles operate in a galvanometer coil. It is quite reasonable to assume that Amyot did not employ an electromagnet and armature, and although he had a kind of "hand organ" cylinder with differently spaced points to open and close the circuit, it does not follow that these spaced points could produce the Morse alphabetical code. Even if they did, July 9, 1838, is not early enough to take priority of invention from Morse, and, moreover, Amyot does not in his description of July 9, 1838, describe a special grouping of points or types to form an alphabetical code. That the system was not considered complete in July, 1838, is evidenced by the fact that on Dec. 31, 1838, Amyot filed another sealed package, containing a table of a telegraphic language and a system of signs proposed by him for use in an electric telegraph. There exists no publication or proof that Amyot ever constructed any electric telegraphs or reduced the ideas in his different communications to practice.

On Feb. 19, 1849, he addressed a communication to the Academy of Sciences, in which he says that a work recently published on the electric telegraph (evidently Moigno's "Le Telegraphie Electrique") does not sufficiently recognize his share in the invention of the electric telegraph, and in another communication of Feb. 26, 1849, he adds that he can prove that at the time when he addressed his communication to the Academy of Sciences in July, 1838, he caused his electric telegraph to be constructed by Lerebours, of Paris, at the request of Baron Mayendorff; that the instrument was sent by the latter to St. Petersburg; that at the same time he offered to construct instruments for the telegraphic service of the government, but was informed by M. Foy, director of telegraphs, that as the invention had become public the government could make the instruments itself in case they were needed, while the law besides was opposed to any one constructing a telegraph outside of his own administration; and, finally, that M. Savary was named to report on his first communication of December, 1837, and was not his co-worker.

It does not appear that Amyot ever advanced the claim that his telegraph was the same as that of Morse, and in the absence of positive proof that any instrument made by Amyot was ever put in practical operation, it must be classed among the telegraph schemes which Amyot in his "Oeuvres Completes" says never had a tangible existence and only appeared on paper, whereas the Morse telegraph was publicly worked before the Academy of Sciences on Sept. 10, 1838.

It appears that when the Morse telegraph was first made known, neither Amyot, Dujardin, Masson nor Breguet, all of whom had devised electric telegraphs in the years 1837 and 1838, raised the claim of priority of invention. The only definite claim to priority of invention came from America, in the form of a letter from Dr. Jackson, of Boston, addressed to Elie de Beaumont and published in the *Comptes Rendus* of March 4, 1839. Jackson in his communication says:

"I regret to see in the journals that Prof. Samuel F. B. Morse has appropriated my electromagnetic telegraph. I explained this instrument to him on board the packet boat *Sully* when I returned to America in the month of October, 1832. I am pained at the unmerited patronage the French scientists have given Mr. Morse; the invention shown them belongs entirely to me. As soon as I heard of his pretensions on this subject I addressed to him my protest, but I notice that he perseveres in his claim. I beg you to inform the Academy that Mr. Morse did not invent the new telegraph, and that I gave him the description of the same in October, 1832."

It does not appear that the French Academy of Sciences considered this claim of Dr. Jackson as warranted by the facts, and besides, Prof. Morse energetically denied the truth of Dr. Jackson's statement. For a time the earlier historians of the electric telegraph attached some importance to the Jackson claim, and we find that the Abbe Moigno[5] in his "Traité de Telegraphie Electrique," published in 1849, said that the Jackson letter made it doubtful whether Morse was the inventor of the electromagnetic telegraph.

The learned Abbe was evidently biased against the Morse telegraph, and had no faith in it, for he says that he does not think it

* Continued from page 320.

[3] Antoine Cesar Becquerel. Born Jan. 18, 1778; died March 7, 1888.

[4] Andre Marie Ampere. Born, 1775; died, 1836.

[5] The Abbe Francois Napoleon Marie Moigno. Born April 20, 1804; died July, 1884.

would solve the problem of electric telegraphy because the mode of production of the signs by the introduction of the time of duration of the current in the composition of the alphabet, are features essentially defective, and must necessarily be abandoned. The Abbe

MOIGNO.

Moigno, in this instance, was not a good prophet, and we will leave him and turn to another writer, who, as far back as 1856, foresaw the great future of the Morse telegraph. In his "Exposé des Applications de l'Electricité," published in 1856, Vol. 2, page 15, Du Moncel says:

"While Wheatstone and Steinheil experimented with their ingenious inventions, Morse in America sought in another way to solve the problem of electric telegraphy. During his voyage in England in 1838 he showed, in fact, privately, an electric telegraph he had constructed, and he sought patent protection at London, but the patent was rejected because of the prior patent of Wheatstone. His telegraph, however, possesses real advantages, as will be indicated further on.

"It has been attempted to carry the invention of Morse back to the year 1832, and to render this more plausible, it is pretended that it was made on board the ship *Sully*, which carried Mr. Morse back to America. In support of this assertion letters of the captain of the ship, and of Mr. W. C. Rives, minister of the United States to France, are submitted; these letters, however, only prove that electric telegraphy was talked about on board the *Sully* and that Morse, like many others, sought to solve the problem. Although he might have said to the captain of the *Sully*: 'Remember, Captain, when my telegraph is the wonder of the world, that it was discovered on board the *Sully*,' this does not prove that the electromagnetic telegraph called the American was imagined at that time. Why did Mr. Morse wait six years before patenting it, experimenting with it or even making it known? On the other hand, what signifies this claim of Mr. Jackson brought to the notice of the Academy of Sciences that Morse had appropriated his invention and that he, Jackson, had completely developed it on board the *Sully*? If letters are considered sufficient proof to establish priority of invention, then this letter of Jackson's evidently offsets those of Mr. Rives and of the captain of the *Sully*.

"Besides, whatever may be the date of the American electromagnetic telegraph, and whatever may be the rights of Mr. Morse in this invention—a telegraph based on the same principle as that of Steinheil—it prevents a real and incontestable improvement which *sooner or later will cause it to be adopted everywhere; the improvement is the use of electromagnets for the designation of, and even for the formation of, telegraphic signals*, and it offers the great advantage of furnishing the dispatch all printed. It is true that the signs thus reproduced are like those of the Steinheil telegraph, only more or less complicated combinations of lines and points which require study to understand them, and considerable time to transmit them; still the system offers to the directors of telegraph lines an infallible means of control, so that the inconvenient features can be overlooked. Besides, the apparatus is very simple in itself, and it does not give rise to an accumulation of errors in the transmission of the signals, and only requires a single line wire.

"In France, where this system is about to be definitely adopted, as it has already been in Germany and America, its use will present the great advantage of avoiding double translations, and this is without doubt the reason which contributed to the abandonment of the old system. It is curious to notice that, notwithstanding the remarkable improvements made upon telegraphs since nearly 20 years, *we return again to carry into practice one of the primitive systems.*"

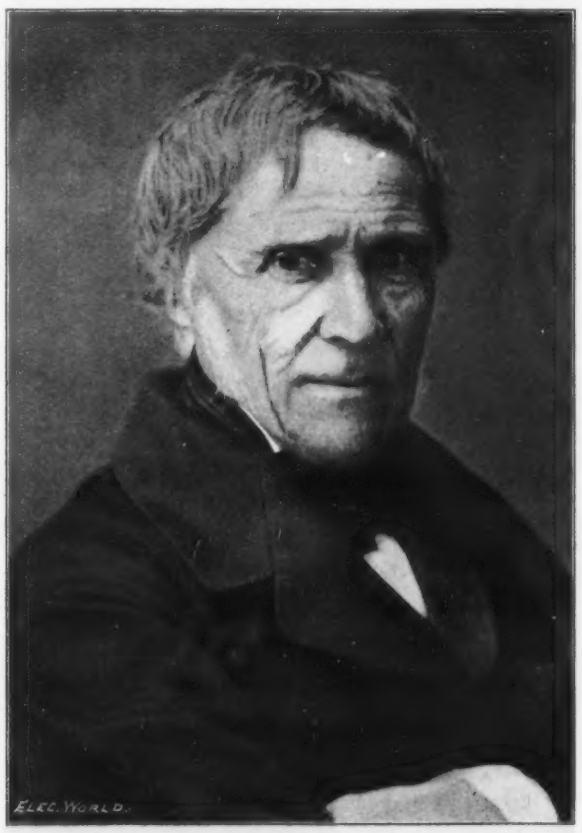
It will be seen from the above remarks of Du Moncel that he gave Morse the credit of having first proposed the use of the electromagnet for the production of and designation of the signs. When he says that the Morse code is similar to that used by Steinheil, he seems to have ignored the fact that the Steinheil instrument, depending upon the use of alternating currents, could make no lines or dashes, but only points which are recorded upon the traveling strip by two astatic needles. Moreover, Du Moncel clearly defined the nature of the invention made by Morse and the underlying principle of the electromagnet and armature to produce predetermined signals. Louis Figuier[6] also, in his "Merveilles de la Science," Vol. 2, page 104, says "Samuel Morse is the creator of the magneto-electric telegraph, and to him belongs the honor of the first telegraph."

J. Gavarret[7], professor of physics at the Academy of Medicine, Paris, also says in his work, "Telegraphie Electrique," published in 1861:

"It is not necessary to discuss the controversable question as to whether the invention of Mr. Morse really dates back to 1832, but it appears to be established in an incontestable manner that during the Summer of 1837, at the time when Steinheil established his telegraph at Munich and Wheatstone proposed the employment of five needles, the American physicist had already constructed the telegraphic instrument now definitely adopted on all the great lines of Europe and America."

This writer was evidently somewhat at fault in carrying the use of the alphabetical code back to the Summer of 1837, as it is known that the instrument worked in New York in 1837 made zig-zag lines in the same manner as the Froment-Pouillet instrument constructed in the year 1845.

In this connection it can be said that Prof. Pouillet formed, together with Arago and Antoine Cesar Becquerel, the commission appointed by the French ministry to fix upon the best telegraphic system for adoption in France. Pouillet or Becquerel in their published works do not dispute the right of Morse to be considered the

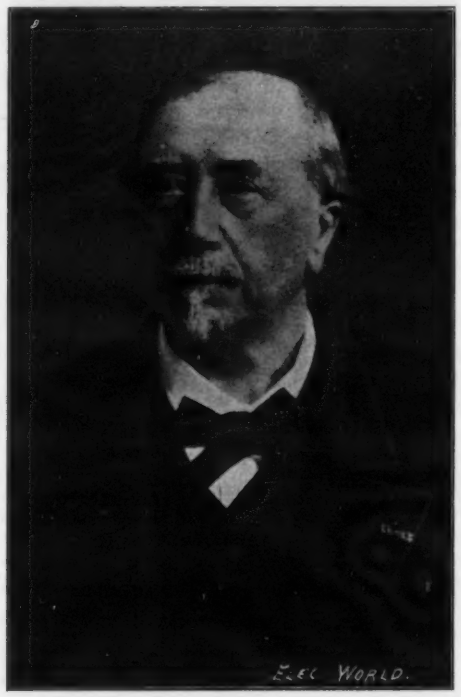


BECQUEREL.

inventor of the electromagnetic telegraph, and it is well known that Arago was always a zealous and determined champion of the Morse

[6] Louis Figuier. Born Feb. 15, 1818; died Nov. 8, 1894.
[7] Jules Gavarret. Born 1809; died Sept. 1, 1890.

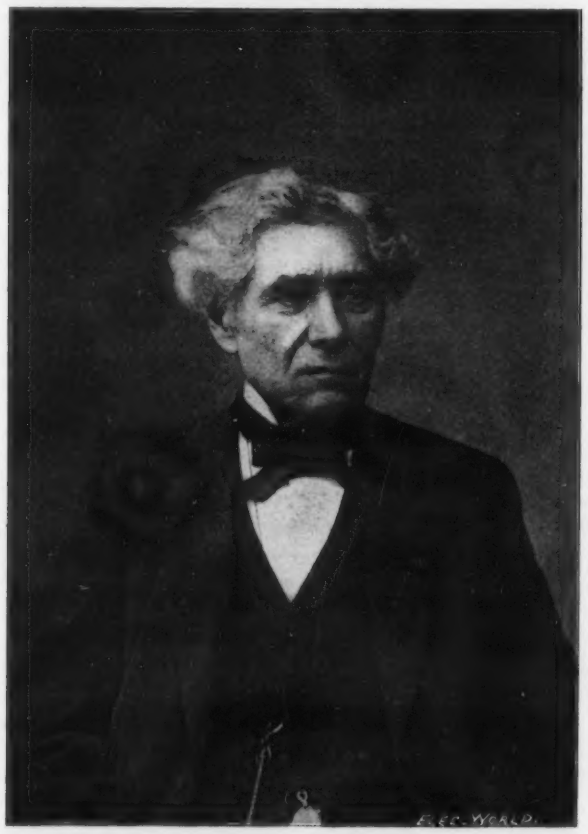
telegraph. Pouillet, after referring to the advantages of the Morse telegraph in his "Elements de Physique," Vol. 1, page 800, says "it is not astonishing that there is a marked tendency in Europe to give the Morse system the exclusive preference. It can therefore be pre-



FIGUIER.

sumed that *his alphabet will soon become the universal telegraphic alphabet.*"

It is also a noticeable fact that the original Morse patent was delivered after it was found to possess novelty, by a commission of which Gay-Lussac was one of the members.



GAVARRET.

As early as the year 1837 the French Academy of Sciences had a permanent commission on electric telegraphs, composed of Arago, Becquerel and Savary. None of these distinguished savants ever questioned the claim of Morse to being the inventor of the electro-magnetic telegraph, and whatever may be said as to the date when the alphabetical code was first thought of, it is clear that there is no published nor acceptable proof that any one but Morse invented it.

An unbiased or impartial opinion based on proof is that the essential features of the modern electromagnetic telegraph—viz., the electromagnet, the armature with its retracting spring, transmitting signals by a finger key, and reading them by sound—were invented or proposed by Morse in the year 1838, and made known to the public at that time. Therefore let Morse forever be considered the father of the electromagnetic telegraph.

Electrodynamic Machinery—XLIX.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

375. If, however, a load torque be imposed on the armature, proportional to the speed, represented by $\tau_1 = a\,n$, then our relation becomes

$$i_1\, r = f + a\, n$$

$$\frac{ir - n\,e}{R+r}\,\tau = f + a\,n \quad \text{from which} \quad n = \frac{ir\,\tau - f\,(R+r)}{e\,\tau + a\,(R+r)} \quad \text{revs. per second.}$$

If, for example, in the last case the motor develops a retarding torque of 60 cm-gms per revolution per second ($a = 60$ cm-gms or 60,000 cm-dynes approximately), we obtain either from the formula or by direct analysis the following results:

	CURRENT.				TORQUE.				DROP IN MOTOR ARMATURE.			SPEED.	
No. of lamps.	Thro' lamp amperes.	Thro' motor amperes.	Thro' shunt amperes.	Drop of pressure in shunt, volts.	Friction, cm-gms.	Speed cm-gms.	Total, cm-gms.	Current thro' motor amperes.	Due to resistance, volts.	C. E. M. F., volts.	Total volts.	Rv. p. sec.	Rv. p. sec. per lamp.
1	0.5	0.083	0.417	0.0417	50	33	83	0.083	0.0083	0.033	0.0413	0.55	0.55
2	1	0.125	0.875	0.0875	50	75	125	0.125	0.0125	0.075	0 0875	1.25	0.625
4	2	0.208	1.792	0.1792	50	158	208	0.208	0.0208	0.158	0.179	2.633	0.658
6	3	0.292	2.708	0.2708	50	242	292	0.292	0.0292	0.242	0.271	4.03	0.667
8	4	0.375	3.625	0.3625	50	325	375	0.375	0.0375	0.325	0.3625	5.42	0.678
10	5	0.459	4.541	0.4541	50	409	459	0.459	0.0459	0.409	0.454	6.82	0.682
20	10	0.876	9.124	0.9124	50	826	876	0.876	0.0876	0.826	0.913	13.97	0.689

376. It is, therefore, evident that a motor armature with constant field excitation can develop a speed closely proportional to the pressure at its terminals, and, therefore, serve as a motor-meter, if the retarding torque be small and constant, or, if it be partly small and constant and partly proportional to the speed.

377. One of the most important recent applications of motors is their distributed application to machine tools in large factories. Instead of employing long lines of counter-shafting, which must necessarily be constantly driven during working hours, a separate electric motor is applied directly to each machine, so that each machine is started and stopped according to its own requirements. Moreover, the regulation of speed, which is obtainable from a common counter-shafting, is necessarily more limited in degree than that which can be effected by the use of independent motors.

378. By the use of individual electric motors, not only is each tool capable of operation at its best speeds, and under complete control, but also the friction of long lines of counter-shafting is eliminated. The economy is greatest where the nature of the work in the machine shop is such that the average power supplied to the tools is much less than the maximum power, or the ratio of average to maximum power; *i. e.*, the *load factor* is small, since the motors, when completely disconnected from a circuit, take no power, whereas, the counter-shafting consumes, practically, the same amount of power friction, whether the tools be active or idle.

379. The consideration of dynamos and motors naturally leads to that of a third class of apparatus, which partakes of the nature of each; namely, *motor-dynamos*, or, as they are sometimes called, *dynamotors*. It is evident that if a motor be rigidly connected to a dynamo, either by a belt or by a coupling, that we obtain a means whereby electric power can be transformed through the intermediary of mechanical power. Thus, the motor may be operated from a high-tension circuit, while the dynamo operates a low-tension circuit, or vice-versa; but, neglecting losses taking place in the two machines, the amount of electric energy absorbed and delivered in the respect-

ive circuits will be the same, the combination being utilized for the purpose of transforming the pressure and current strength. For this reason a motor-dynamo is commonly called a *rotary transformer*, in order to distinguish it from a transformer of the alternating type, which always remains at rest.

380. Instead of rigidly connecting together two separate machines; *i. e.*, two armatures in two separate fields, the plan has been adopted of placing the two armatures in a field common to both ; as, for example, by placing them in a common field of double length. Or, a still closer union can be effected by winding both the armature and motor coils on a common armature core, care being taken to insulate

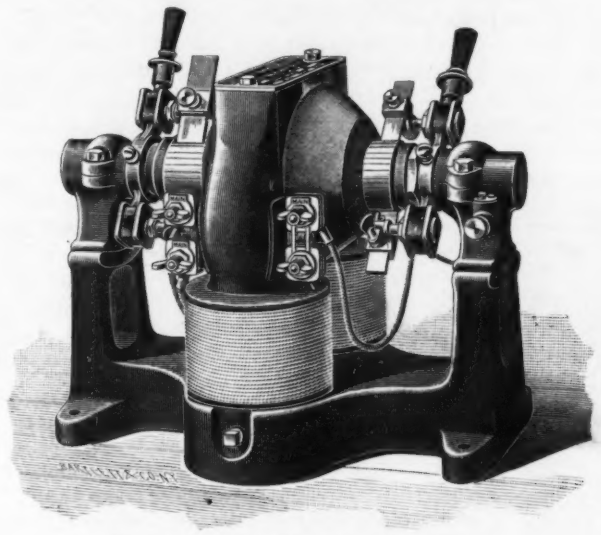


FIG. 221.—STEP-UP MOTOR-DYNAMO.

the two sets of windings from each other. Under these circumstances, since the intake of the motor winding is practically equal to the output of the dynamo winding, the space occupied by each winding will be practically the same, so that where both are associated on a common core, half the winding space is appropriated for each. The result will be that if the motor winding or dynamo winding be such as would appertain to, say a 10-KW capacity, the machine in which the two are associated will be a machine having, approximately, the size and weight corresponding to 20-KW capacity. There is, however, an economy in constructing one machine of double capacity, instead of two machines of single capacity, both in first cost and in efficiency.

381. Rotary transformers, like all transformers, may be either of the *step-up* or *step-down type*. Fig. 221 represents a step-up rotary transformer of 1.5 KW capacity, transforming from 120 volts and 12.5 amperes to 5,000 volts and 0.3 ampere. The motor winding of the armature is connected with the commutator on the left, while the generator winding of the armature is connected with the commutator on the right. The magnet coils are excited from the low-tension mains. The two armature windings, in such cases, may be either placed one below the other, or they may be interspersed. The left hand brushes receive the 120-volt pressure, and the right hand brushes deliver the 5,000-volt pressure. The function of such a machine is to test high-tension insulation under practical conditions of pressure.

382. Fig. 222 represents a step-down rotary transformer for transforming from 500 to 120 volts. In this case the smaller brushes are connected to the 500-volt mains, as is also the field winding, and the lower pressure is delivered at the heavy brushes.

383. It is important to observe that in a motor dynamo of the preceding types there is no appreciable armature reaction. The reason for this is as follows: The M. M. F. of the motor armature winding is, as we know, opposite in direction to that of the generator winding ; and, since these M. M. Fs. are nearly equal, and are produced in the same core, they will nearly neutralize each other. Consequently the brushes of such a machine never require to be shifted during variations of load, and the commutators are characterized by quiet and sparkless operation.

384. Under ordinary circumstances it is necessary to excite the field magnet of a motor dynamo from the primary circuit, since, otherwise, the motor side could not be operated. It is often possible, however, to place a series winding on the motor side, and a shunt winding on the secondary or dynamo side. Thus, if it be required to transform from 1,000 to 50 volts, a shunt-field winding for 1,000 volts would be more expensive than one for 50 volts. In such a case it becomes possible to excite the fields by a few turns of series winding, carefully insulated, in the primary circuit, in order to start the machine from rest, and to supply the balance of the field excitation by a shunt winding on the secondary side, which commences to be actuated as soon as the motor starts.

385. It will be evident that any variation in the strength of the field magnets, whether these be shunt or series-wound, will not vary the ratio of transformation, for, although by varying the field excitation the motor can be made to run faster, yet this speed will not produce any appreciable effect upon the generated E. M. F., since the field is proportionally weakened. In other words, the C. E. M. F. in the motor being always equal to the E. M. F. at the brushes, after deducting the drop in the armature, the generated E. M. F., which is always some fixed fraction of the motor C. E. M. F., must be constant within the same limits. If the number of turns in the motor winding, counted once all round the armature, be w_m, and the number of turns in the generator winding counted in the same manner be w_g, then the ratio $\frac{w_g}{w_m}$ is called the *ratio of transformation*. If, then, the primary E. M. F. be E_1 volts, the primary current I_1 amperes, and the resistance in the primary winding r_1 ohms, while the corresponding quantities in the secondary circuit are E_2, I_2, and r_2, respectively, the C. E. M. F. in the primary winding will be $n e_1 = E_1 - I_1 r_1$, where n is the speed of revolution in turns-per-second, and e the dynamo power, or $\Phi w_m \times 10^{-8}$. The generated secondary E. M. F. will be $n \Phi w_g \times 10^{-8}$ volts $= (E_1 - I_1 r_1) \frac{w_g}{w_m}$.

The pressure at the secondary terminals will be further reduced by the drop in the secondary winding; or,

$$E_2 = (E_1 - I_1 r_1) \frac{w_g}{w_m} - I_2 r_2.$$

If the weight of copper in the two windings is equal, $I_2 r_2$, will practically be equal to $\frac{I_1 r_1 w_2}{w_m}$, so that

$$E_2 = E_1 \frac{w_g}{w_m} - 2 I_2 r_2.$$

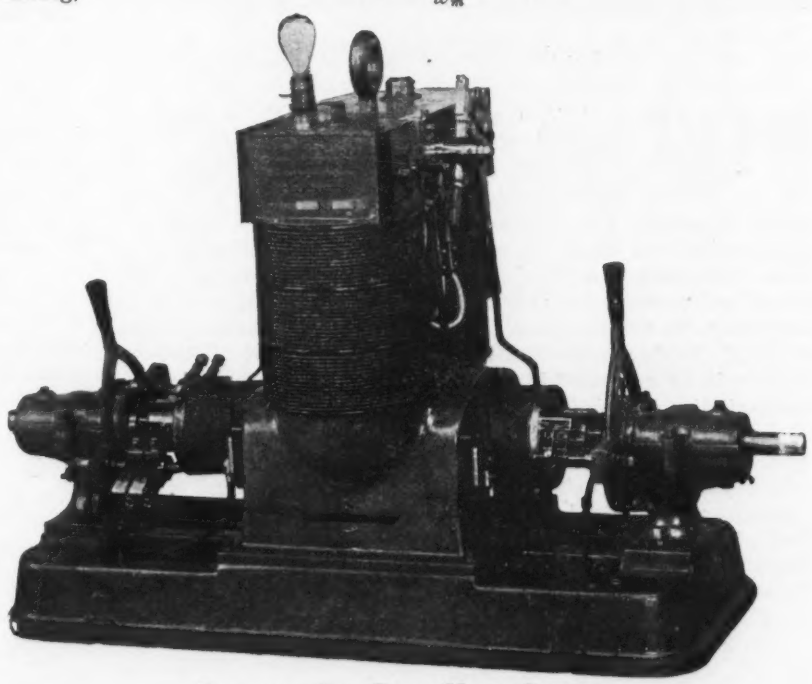


FIG. 222.—STEP-DOWN MOTOR-DYNAMO.

The machine, therefore, acts as though it were a dynamo of E.M.F. $\frac{w_g}{w_m} E_1$, with an internal resistance of $2r_2$, or twice that of the secondary winding.

386. In all motor dynamos, having a field magnet common to both armatures, the ratio of transformation, neglecting armature drop, is constant, no matter how the field excitation is varied.

Motor generators are often employed for raising or lowering the pressure of continuous-current circuits. Thus electroplating E.M.Fs. of, say 6 volts, are obtainable in this manner from circuits of 110, 220 or 500 volts pressure. Similarly, pressures of 150 volts are obtainable from a few storage batteries by such apparatus.

387. In central stations for low-pressure distribution, say at 220 volts, by three-wire system, some of the feeders have to be maintained at a higher pressure than others, in order that all the *feeding points*, or points of connection between feeders and the mains, should have the same pressure. This is accomplished either by employing separate dynamos, operated at slightly different pressures, or by introducing at the central station motor dynamos having the dynamos in circuit with the feeders. Such motor dynamos are frequently called *boosters*. The motor dynamo for this purpose requires that means should be provided for regulating the E. M. F. which is to be added to the feeder circuit. This can only be done by employing separate field magnets for the motor and generator armatures. Fig. 223

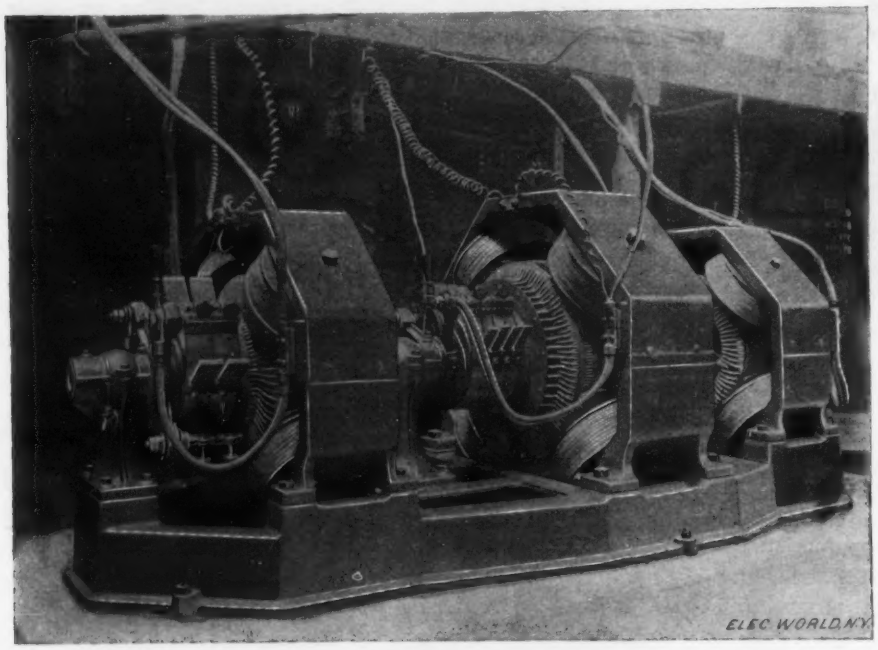


FIG. 223.—BOOSTER IN THREE-WIRE CENTRAL STATION.

represents a practical form of booster employed in a three-wire central station. The middle machine is a motor operated at central-station pressure, of perhaps 250 volts; the others are generators, having their armatures coupled to the same shaft as that of the motor armature. One dynamo is connected in circuit with the positive conductor of the feeder whose pressure is to be raised, and the other is connected in the circuit of the negative conductor. Since these feeders carry heavy currents and require to be of very low resistance, the necessity for the massive copper brushes and connections of the dynamos will be evident. The amount of E. M. F. which will be generated in these armatures will be determined by the excitation of their field magnets.

388. We have now completed the consideration of the construction and operation of continuous-current electrodynamic machinery. There yet remains to be considered the important subject of alternating-current electrodynamic machinery. This will form the subject of a separate serial to be entitled, "Alternating-Current Machinery" which will, however, be independent of the preceding, in so far that it can be understood without reference to the past serial.

Laboratory of Houston and Kennelly, Philadelphia.

Underground Electric Road at Budapest.

Messrs. Siemens & Halske, of Berlin, are constructing an underground electric road at Budapest. The tunnel will be 9 feet high and 19 feet 8 inches wide. The cars will carry 30 passengers and will be 32 feet long. An automatic block system has been adopted, the wires being arranged so that two trains cannot be on the same section at one time. The voltage to be used is 300.

Oersted and Romagnosi.

To the Editor of The Electrical World:

Sir:—In your issue of Sept. 14, as well as in that of the previous week, I have observed footnotes to the articles of your series entitled "The Invention of the Electromagnetic Telegraph," which indicates that the belief still lingers in the minds of many that the Italian, Romagnosi, did, indeed, in some sort anticipate the discovery by Oersted of the composite science of electromagnetism.

From my own experience, I do not doubt that this error (probably due originally to a misunderstood description), has been kept alive and propagated, by means of the unquestioning acceptance by successive writers of the statements of their predecessors.

As I, however, over 10 years ago, was one of the chroniclers who, without proper investigation, repeated the Romagnosi story, and perhaps thereby aided in perpetuating the masquerade of legend in the garb of history, I have determined on this occasion to make the *amende honorable*, and to do what I can to prevent the further circulation of what seems to be clearly a myth.

I first saw the Romagnosi story in Robert Sabine's "Electric Telegraph," New York reprint, 1869, p. 23. Subsequently it was stated in similar terms in Taylor's Memorial of "Henry's Contribution to the Electro-Telegraph," and still later I repeated the assertion in some historical notes incorporated in a book on "Electricity, Magnetism and the Electric Telegraph" published in 1883.

But in Mr. Fahie's remarkable and interesting work, "A History of Electric Telegraphy to the Year 1837," London, 1884, pp. 257–262, the recital of what Romagnosi really did, as it originally appeared in the *Gazetta di Trento* of Aug. 3, 1802, is reprinted, and a careful reading of the same must, I think, convince any candid person understanding the subject, as it has Mr. Fahie, that the Romagnosi experiment has "no relation whatever to electromagnetic action," but deals with "effects of ordinary electrical attraction and repulsion brought about by the static charge which is always accumulated at the poles of a strong voltaic pile."

It is abundantly evident after reading this transcript of the original account, that Romagnosi did not employ a closed circuit; that he did employ one pole only of the pile; that he actually made contact between the terminal of the pile and one end of the needle; and that after a moment or two of such contact the needle having become statically charged with electricity of the same sign as that of the pile terminal, experienced the repulsion that was to be expected. In short, Romagnosi had simply repeated the experiment of Franklin's friend, Kinnersly, described in the "Philosophical Transactions," 1763.

To quote from Fahie's "History" the original Romagnosi account, would be to unduly lengthen this communication; but since the book is readily accessible, any of your readers who take sufficient interest in the question can read it there; and it may be that from your knowledge of the extent of such interest, you may consider the statement there made worthy of republication.

THOMAS D. LOCKWOOD.

The Sun as a Magnet.

Commenting on a theory offered by Mr. John Jones, the *English Mechanic* says that Mr. Jones observed the magnetization of the solar light on Oct. 19, 1879, by staring at the sun *with the naked eye* for half an hour until he saw dark and bright bands oscillate pendulum-wise on the sun's limb 27 times per half-minute. This proved that the sun's nucleus rotated in 1.1 second round the solar axis. It is this rotation of their magnetic nuclei which makes the stars twinkle.

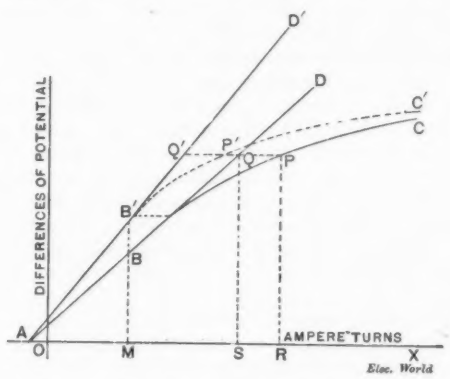
Electricity in Farming.

Thrashing corn by electric power is at present being satisfactorily done at Mjolby, Sweden, current being conveyed a considerable distance for this purpose.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE BY CARL HERING
COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Modifications in the Characteristics Due to Different Air Gaps.—In "L'Eclairage Elec.," Aug. 31, Mr. Brunswick describes a simple, graphical method by means of which a given characteristic (showing the relation between the excitation and the voltage) can be converted into another corresponding to a different air gap; in practice it often becomes necessary to change the air gap and by the present method the new characteristic can readily be determined graphically. The characteristic for open circuit he divides into the straight line portion and the curved portion; he assumes that for low inductions the only magnetizing force required is approximately that for the air gap; the straight line portion indicates the variation of the flux in the air gap and as the reluctance of the gap is proportional to its length, the new straight line portion is changed so that the tangent of its angle is inversely proportional to the air gap, or in other words, one of the ordinates is simply changed in proportion to the air gap; this defines the new position of the straight line portion. Referring to the accompanying figure, *A C* is the original characteristic of which *A B* is the straight



line portion; this is changed to *A B′* by increasing the ordinate *B M* to *B′ M* in the ratio of the old to the new air gap; the curved portion in dotted lines is then found by the following method; *O R* is the magnetizing force corresponding to the point *P* and of this portion *O S* represents the magnetizing force for the air gap while *S R* represents that for the other parts of the magnetic circuit and is therefore independent of the air gap; if therefore on the same horizontal line with *P*, the distance *Q′ P′* is made equal to *R P* then *P′* will be the corresponding point on the new curve. He then describes a similar method for a characteristic for a given current; it is assumed that the change in the air gap is not sufficiently great to affect the armature reaction; at first draw a new characteristic in which the ordinates are increased by an amount corresponding to the ohmic resistance of the armature, then draw a horizontal line from any point *P* of this to the open circuit characteristic for the first air gap, pass an ordinate through the point where it intersects, extend it to the open circuit characteristic for the new air gap; then the vertical distances between the two latter points give the vertical distance to which the original point *P* must be moved to give the corresponding point of the new characteristic.

Variable Speed Motor.—In the "Elek. Anz.," Sept. 1 and 5, Mr. Schulz describes a method which he has devised for regulating motors, by means of which any speed may be obtained from full speed down to one quarter speed and without any adjustable resistance in series with the armature. It was devised especially for motors for use in printing fabrics. The motor described is one for 10 hp making 600 revolutions at 300 volts and runs at any speed from that down to 150; it is a bipolar series machine with a single armature winding and having 76 coils; the magnet winding consists of a chief and an auxiliary winding, the former having 224 and the latter 2,240 windings, and in addition there is a rheostat shunting the auxiliary winding; for the slowest speed this rheostat is opened, the whole current passing through all of the windings, which produces a very strong field; the efficiency then is about 60 per cent.; for the fastest speed the regulator is short-circuited and no current will therefore pass through the auxiliary winding; the motor then makes 600 revolutions and has an efficiency of 80 per cent; by suitably adjusting the regulator any intermediate speed can be attained at an efficiency lying between 60 and 80 per cent. To vary the speed in the ratio of 1 to 8 instead of 1 to 4, and without diminishing the efficiency he proposes to use a double winding on the armature and two commutators, the rest of the construction being the same; these two armatures may then be connected in series or multiple, in addition to adjusting the regulator. He shows how variable speeds may also be obtained from a five-wire system, by a shunt motor, the magnet winding of which is connected to the outside wire and the double armature to different ones of the middle wires. In conclusion he shows what the saving of power would be in a fabric printing establishment if the speed be regulated as he described instead of by means of a resistance in series with the armature.

Carbon Brushes for Heavy Currents.—In the Lond. "Elec. Rev.," Sept. 6, Mr. Hartmans describes some unsuccessful and some successful carbon brushes which he tried with a 10-pole machine for 500 amperes and 250 volts. Copper stencil brushes did not suffice; he then tried a copper brush with a small block of carbon secured to the toe where the sparks occur, forming practically a brush whose end was one half carbon and one half copper; this was a decided improvement, but only for a short time, as the wear of the copper brush caused a gap to be formed between the two and sparking again commenced; in the next form the carbon was secured very rigidly to the copper, but capable of being fed separately; this was better for awhile, but soon a number of flats made their appearance on the commutator; the carbon holder was somewhat heavy; a copper brush was then tipped with a carbon block mounted in copper; this was an improvement, but the carbon had a tendency to become red hot in spots when the full current was on; by making the carbon double the width the result was much better; the best arrangement was found to be two pairs of copper brushes alternating in position with one pair of copper brushes tipped with carbon, the latter brushes being set somewhat less than one section in front of the copper brushes; this gave the best results for the largest loads; no marking of the commutator took place under the carbon brushes and it was hardly perceptible under the copper brushes after nearly a month; in this arrangement the tension on the carbons should exceed that on the copper brushes sufficiently to enable them to take their full share of the current as nearly as possible.

Efficiencies of Dynamos and Motors.—In "L'Elec.," Aug. 24, Mr. Brunswick discusses the statement often made that a dynamo when used as a motor has about 5 per cent. less efficiency. He assumes that the counter E. M. F. of the motor is equal to the total E. M. F. generated by the dynamo. Taking the case of a series dynamo, the speed being the same, he shows that when used as a motor "its efficiency will be greater, equal to or less than that when used as a generator, according as the power dissipated in heating is greater, equal to or less than the power lost to overcome the passive resistance"; in all good machines in which the commercial efficiency is very close to the electrical efficiency, the first of these conditions is the one which generally exists. He then shows that the same is true of shunt and compound machines.

Armature Reaction in Multiphase Dynamos.—In the "Elec. Zeit.," Aug. 22, Mr. Behrend refers to the recent article by Mr. Korda (see Digest, Sept. 7), in which it was stated that there would be no undulations in the exciting current of three-phase generators; he claims that, as a matter of fact, such fields, even with zinc currents, are not constant, as is shown in Kapp's "Transmission of Energy," and therefore the exciting current also pulsates; it does this with a frequency six times as great as that of the main current.

Phase Difference for Various Loads on Transformers.—The "Elek. Zeit.," Aug. 29, contains a short article by Dr. Puluj, in which he gives the results of measurements made with his phase indicator (see Digest, Dec. 23, 1893, and Feb. 3, 1894; for a modified form see April 6), on an installation in which 25 transformers were in use; experiments have been recorded for single transformers, but not for a bank of them, and the present tests were, therefore, made to determine these relations for an installation containing a number of transformers. The test is briefly described and the results given in a table; it appears from this that when the load was about $\frac{1}{3}$ of the total, the power generated by the alternator was 6.4 per cent. smaller than the product of the volts and the amperes; the cosine of the angle diminishes with the load and reaches the value 0.8087 for about $\frac{1}{10}$ of the total load.

Theory of the Synchronous Motor.—The Physical Society paper by Mr. Rhodes, mentioned in the Digest, Sept. 7, is reprinted in the Lond. "Elec.," Sept. 6.

Starting Three-phase Motors.—The cuts from the article abstracted in the Digest last week, under "Installations," showing the Kolben method of starting alternate-current motors, are reprinted in the "Elec. Eng.," Sept. 18.

LIGHTS AND LIGHTING.

Researches with the Alternating-Current Arc.—An interesting paper by Mr. Georges is published, with a number of illustrations and curves, in "Elek. Zeit.," Aug. 22; he gives the results of a large number of experiments made with the alternating arc by Mr. Oelschlaeger, Dr. Michalke and Mr. Queisser. Regarding the frequency, he states that the limit at which the pulsations can be noticed by the eye is a frequency of 60; at 40 the light is still unbearable, and at 50 the pulsations may still be noticed; a ground glass globe or a reflector will make the pulsations less perceptible. The length of the arc has an important effect on the light for the same amount of energy; on account of the shadows of the carbons, the length of the arc must not be made too small; the temperature of the carbons is greatest when they are nearest together; curves are given showing the light given out at various angles for different lengths of arc and for the same amount of energy, the curves being reduced to the number of candles per watt. The form of the current curve has a very great effect on the arc, and as the armature reaction affects the curve form, it is preferable in making such researches to use large machines; different forms of current curves may be obtained by making different connections in three-phase machines and this means was used in the present researches. The noise made by the lamp depends very greatly on the form of the curve; with a sine curve the note is soft and musical; with curves in which there are sudden changes, overtones and impure notes were reproduced; there is besides this a much more disagreeable noise depending on the curve form and on the nature of the carbons; this occurs most frequently with pointed curves, less with flat and seldom with sine curves; with some carbons it is impossible to get rid of it, while with others this noise is never produced. The voltage of the arc is dependent on the current curve; with the alternating arc the voltage must reach a definite value in order to relight the arc; this must be greater the more pointed the current curves, but, in spite of this, the mean voltage of the pointed curve is less than that for flat curves; they found that for a 2 mm arc and a pointed curve 23.5 volts were required and with a flat curve 30.5; the voltage must therefore be chosen in accordance with the current curve, and it is therefore not possible to adjust such lamps in the factory; the higher voltage of the flatter curves may be preferred, as the lamps then take less current. The temperature of the points and, therefore, the candle-power is determined chiefly by the energy consumed; at very great frequencies the light is probably independent of the current curve; in the frequencies used in practice the light is greater the flatter the current curve; they found, for instance, for a 12-ampere lamp the mean spherical intensity per watt was 0.960 candles for a flat curve and 0.796 for a pointed curve; the better efficiency of the flat curves might be explained by the fact that with pointed curves there is a longer time when the current is small, and during this time the carbons will cool and the light diminish; it might be said that the eye may possibly measure the light by a different mean value, just as a dynamometer does not measure the algebraic mean of a current. He then describes a number of photographic measurements of the light, measured momentarily; a synchronous motor was used which revolved a disc with a slot, behind which was placed some sensitive paper; the results are given in the form of rings varying in darkness in the different parts, each portion of the paper being illuminated only by one particular phase; the tests were repeated with opal globes and reflectors; some of these show that the light still varies with the current for frequencies as high as 300 per second. Successive photometric measurements of the light for a complete period were made together with measurements of the current and the voltage curves, for flat, pointed and sine curves, the results being given in the paper in the form of curves. The photometric measurements were made with a disc having a slot, and rotated by means of a synchronous motor; in front of the movable disc was a fixed disc having a similar slot and the light was measured only at the moment when it passed through both slots; instead of moving the slot to different positions, the current for the motor was transformed in a three-phase motor, the stationary part of which was supplied from the same machine which ran the lamp while the current induced was used to drive the synchronous motor; any phase shifting can then be produced by changing the position of the part in which the current is induced. The resulting curves show among other things how little the negative maximum exceeds the two minima; the positive maximum is quite great; during the time of the greatest current there is an accumulation of heat shown by an increase in the light; this is specially noticeable with the flat current curve diagram; the phase shifting between the voltage and current is decidedly positive near the zero line, that is, as if it was produced by a self-induction; it is also clear that for the higher values of the current there is a negative shifting; for the flat curves the current and light curves are shifted toward the left in relation to the voltage curve, which might be explained by the assumption of thermoelectric counter forces in the arc; for the greater currents there is a greater difference of temperature between the carbons, and the thermo-electric force is therefore greater at the positive carbon and generates an E. M. F. which is opposed to the current and hence diminishes it; the curve should not be used to compare the efficiencies of the arc for different current curves, as the former are only approximately correct.

In the discussion which followed Mr. von Dobrowolsky called attention to the fact that the current curves do not remain at zero any appreciable time, which is contrary to the assumption that the arc is re-lit at each alternation. Mr. Webber suggested that it is quite probable that the hot air conducts directly and that the current can pass through it without forming an arc. He suggests that the results obtained might be quite different if different carbons were used, as he found, for instance, that for the same current of six amperes and equal arcs of two mm, the number of watts was 142 with two cored carbons and 266 with two solid carbons; with a cored carbon at the top 168, and with a cored carbon at the bottom 159 watts. He states having measured the phase difference produced in the arc the results being obtained by measuring the energy in a watt-meter and taking the difference between that and the product of the volts and the amperes; with two cored carbons it was nearly zero, while with two solid carbons and for a hissing arc the phase difference was 42.5°, for the quiet arc 35°, while with a cored and a solid carbon it was 24°; the arc is therefore quite different, depending on the carbons. In the tests described by Georges, cored carbons were used. Mr. Meissner stated that the effect of the heated gases can be readily shown in starting a continuous-current arc, when it will be found that after it has burnt for some seconds the carbons can be pulled apart much farther than before. When a porcelain or slate rod was introduced in the arc through the centre of the carbons, the length of the arc could be made five or six times as great for the same voltage, showing that the conductivity of the gases affects the length of the arc. Similar results were referred to in connection with the blowing of fuses. Mr. von Dobrowolsky doubted the correctness of the large phase-shifting noticed by Webber and attributed it to errors in the instruments, which, however, Webber refutes, stating that Prof. Ayrton had obtained similar figures. That hot gases conduct was doubted by some, but Webber thought there was no doubt, and referred to the results of Pringsheim (see Digest this week). Mr. Georges believes that the tests leave little doubt that there is a counter E. M. F. in the arc, a point about which there was some discussion.

Mr. Cahen in the "Elek. Zeit.," Sept. 5, refers to the above paper and proves that the difference between the apparent and the true watts in an alternating-current circuit cannot in general be said to prove with certainty the existence of a phase difference or a counter E. M. F.; he deduces some equations for the power factor and shows that its value is unity only when the ratio of the voltage to the current, that is, the apparent resistance, has the same value at every instant; whenever this is not the case this factor will be less than unity; if it is assumed that there is no counter E. M. F. in the alternating arc then this ratio gives the instantaneous value of the total resistance, but as the latter is subject to great variations during a complete period the power factor can turn out to be relatively small while the curves may not show a decided phase shifting. This also explains the phase shifting which has often been noticed, due to a load or incandescent lamps, as in this case also the resistance of the filaments is dependent on the momentary strength of the current; with an inductionless resistance the agreement between the measured watts and the product of the volts and amperes will be very good for small loads, but with large currents the changes in the resistance may produce decided differences. This apparent phase shifting differs from the true in that the latter increases with an increasing frequency, while the former becomes less as the frequency increases because the resistance has not time to follow the changes in the current.

Comparative Measurements of Different Sources of Light.—The "Elek. Zeit.," Aug. 22, contains a paper by Mr. Wedding in which he discusses chiefly the Welsbach and acetylene lights. In his conclusions he gives the following as the order of the different lights, in respect to cost: Welsbach, alcohol incandescent, petroleum, argand burner, electric incandescent and acetylene; he adds that better than all of these is the electric arc light; for the same energy the latter gives seven times more light than the electric incandescent, and the cost is, therefore, one seventh; he adds that there are, besides the price, a number of advantages of the arc light, in which it excels all the others. Even if the costs of the arc and the Welsbach light are equal, the former has so many advantages over the latter that the lighting of large areas is accomplished much better by the arc light.

Cost of an Arc Lamp per Year.—Some figures given by Judge Hamilton giving the "usual cost of operating and maintaining an arc lamp per annum" are given in the "Elec. Eng.," Sept. 18; four pounds of coal per hour for 12 hours would be required for every 2,000-cp lamp for 4,000 hours per year; in Albany this would cost $26.40 per year; other items which he enumerates bring the cost of supplies to $58.40, to which is added labor, $29, and interest and depreciation, $43.33, making a total of $130.73. In 101 cities in the United States having all-night service, the average annual charge is $150.72.

In an article on municipal lighting by Mr. DeLand in "Elec. Eng'ng," for September he gives two full-page tables taken from the reports for the past three years, of the city electrician of Chicago; neither interest nor depreciation appears, nor insurance, taxes nor rent; the total number of lamps is 1,110; the cost, excluding the above items, is $92.76 for about 4,000 hours; adding an estimate of the above items brings it up to $153.48, which he says is more than should be asked, but it is doubtful whether this will be materially reduced until the stations are operated at their full capacity; from large modern stations current can be delivered at $70 per year per lamp. A plan is described by means of which that city is to

receive a plant free of cost in about five years, paying meanwhile $113 per lamp per year.

Phenomena Observed with the Arc.—The article of Mr. Nodon, which was abstracted in the Digest, July 27, is reprinted with the illustration in "El'ty," Sept. 18.

POWER AND HEAT.

Power and Light Installation at the Copenhagen Harbor.—A long and profusely illustrated description of this installation is published in the "Elek. Zeit.," Sept. 5, including a good diagram of the complete connections at the stations; the three-wire continuous-current system is used in conjunction with accumulators; the installation includes a number of cranes and lifts.

Electric Furnaces.—A translation of an article by Mr. Moissan, on "Electric Furnaces and Chemistry at High Temperature," from "La Nature," Aug. 10, is published, with an illustration of the furnace, in the Lond. "Elec. Rev.," Sept. 6; he gives a good summary of the results which he has obtained with this furnace, most of which have been noticed in these columns.

Electric Plowing.—A brief article giving data regarding the installation at Enguibaud in the department of Tarn, France, is given by Mr. Laffargue in "La Nature," Sept. 7.

Power Plant at Salt Lake City.—In the "Elec. Eng.," Sept. 11, Mr. Guy gives an illustrated description of the plant which is to be erected to supply Salt Lake City with electric power and light. The power is to be derived from the river in the Big Cottonwood Cañon about 14 miles from the city; the minimum power of the falls, which has a height of 380 feet, is 2,447 hp and nearly 4000 during nine months of the year; it is intended to deliver 40,000 hp-hours daily in the city, the efficiency of transmission being 68 per cent.; the generating plant consists of four 450-kw three-phase generators, which will be operated in parallel; by means of six step-up transformers the voltage will be raised to 10,000; the line loss is 5 per cent.; the line consists of four circuits of three wires each, all of No. 2 soft, bare copper. It is intended to abandon the steam plants in the present stations in that city and to use this power instead. The total cost is estimated at $300,000 or $132.72 per net hp delivered in the city. In the secondary network a neutral wire will be used and the lamps are to be connected between this neutral and the other mains; in the city the current will be transformed down to 2,000 volts.

Electric Furnaces.—A translation of the paper of Mr. Street, which was abstracted in the Digest, July 27, is begun in the "Elec. Eng.," Sept. 11; it is a reprint of the translation mentioned in the Digest, Sept. 14.

TRACTION.

Underground Railway in Budapest.—In a note in the Lond. "Engineering," Sept. 6, it is stated that the cars for this road will be 32 feet long, and will be carried on two four-wheeled trucks nearly at the extreme ends, the car body being dropped between them in order to gain height; each car accommodates 30 passengers; the current will be taken from overhead wires, at 300 volts; arrangements are made so that the doors cannot be opened until the motor stops, nor can the cars be started until the doors are closed; this is necessitated by the small clearance in the tunnels; there will be an automatic block system cutting off the current from a train entering a section already occupied; the estimated cost per mile for the line and equipments is given as $650,000; it is being constructed by the firm of Siemens & Halske.

The B. & O. Locomotive.—According to the "Elec. Eng.," Sept. 11, Mr. Caswell, "an expert mechanical engineer of Indianapolis," is said to have stated that the motors on these locomotives are very unsatisfactory, and that it is doubtful whether they will be used any great length of time; that they have been a constant source of trouble and expense, owing to the defects in the overhead system; a peculiarity of the locomotive lies in the fact that it tends to start the load with a sudden jerk, and this strains the machinery.

In the issue of Sept. 18 Mr. Knight, of the General Electric Company, replies to these statements, which he says are unwarranted; he asserts positively that there is nothing to complain of as far as he knows; it has been in continuous service for about a month and has handled all the freight trains; there have been no mishaps, and there has been a remarkable freedom from trouble, considering the many novel features involved; the locomotive handles trains easily and in a gradual manner, the shocks being less than with a steam locomotive; the overhead system gives absolutely no trouble; the trolley carries as high as 4,000 amperes, and the locomotive has been run at a speed of 60 miles an hour; trains weighing 1,400 tons have been handled up a 0.8 per cent. grade with perfect ease. "The locomotive seems to leave little room for improvement, and will undoubtedly continue for many years in its present shape, and perform the service for which it was designed."

Hauling Freight with Electric Cars.—Some recent tests made on the Nantasket line are given in "Elec. Ry. Gaz.," Sept. 14. A two-motor car was connected with nine freight cars weighing 302 tons, but this was too much until reduced to five cars; a four-motor car was ballasted with 5,000 pounds of iron and drew seven cars weighing 234 tons which was increased to nine cars of 303 tons; when the ballast was increased to five tons the car easily pulled 10 freight cars weighing 335 tons; 12 cars weighing 400 tons were handled without difficulty; both motor cars were coupled together and successfully hauled 30 cars weighing 954 tons. A speed test was made and a speed of 72 miles an hour was attained.

Traction Motor Regulation.—The Henry system in which a three-wire circuit is necessary, is described and illustrated in the "Elec. Eng.," Sept. 18; the object is to avoid the waste of energy in passing the current through a dead resistance in regulating the speeds. A three-wire system is used, the rails being neutral (it appears that there must be a double trolley); there are two compound generators in series, one for 500 volts and the other for 300, their junction being connected to the neutral wire; there are two motors on the car, and the controller connects them in various ways with the two circuits of different voltages, so as to obtain different speeds without the introduction of any dead resistance.

Liverpool Elevated Line.—Some figures regarding the working of this line are given in the "Elec. Eng.," Sept. 18.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Aberdeen.—A long, illustrated description of this station is given in the Lond. "Elec. Eng.," Sept. 6; it is a moderately small continuous-current, accumulator station; detailed drawings of the underground mains and detailed data of the accounts are given.

Accumulator Plant in Boston.—In the "Elec. Eng.," Sept. 18, Mr. Key gives an illustrated description of the storage battery plant of the Boston Edison Company. Tudor accumulators from Germany were installed and have now been in use about 18 months; there are 144 cells each containing 37 frames, the positive containing 16 and the negative four plates each; they stand on plates of glass set on edge, leaving a space of about six inches below the plates for the sludge; the surfaces of the plates contain grooves "with intersecting indentations running at right angles to the grooves"; the cells contain 640 liters of acid; the water used is first distilled. The batteries seem to be connected and disconnected by the usual system, the end cells being connected and disconnected automatically by means of small electric motors; the aggregate maximum capacity of the battery plant is about 30,000 amperes (but for how long is not stated); it has been found that the batteries come cheaper than the steam plants of the same capacity; they carry the entire load during nights and Sundays; the most important advantage is the property to even up the load on the engines which never becomes less than three fourths of their capacity. thus securing a saving which more than counterbalances the 25 per cent loss in the battery; the accumulators are kept in repair by the makers at 4 per cent. per annum; the plant is said to be very satisfactory.

WIRES, WIRING AND CONDUITS.

Wiring Rules in Paris.—A brief abstract from the rules recently published by the Paris municipality are given in Lond. "Elec.," Sept. 6; among the rules are the following: that the resistance of the copper shall not be more than 1.8 michroms per cb. cm corresponding to a conductivity of 97 per cent.; the cross-section is to be such that twice the normal current will not heat it more than 40° C.; the maximum current densities allowed are 1,935 amperes per square inch for wires between Nos. 18 and 13 B. W. G., 1,290 amperes for Nos. 13 to 1 and 645 for larger conductors; for bare conductors the density is double the above figure; no single wire smaller than No. 20 is allowed; fuses must melt for currents equal to not more than three times the normal; rheostats for arc lights must not reach a higher temperature than 200° C.; fixtures serving both for gas and electricity are to be mounted on insulated bases having a resistance of at least half a megohm; every conductor connected to the mains with switch or fuse shall have an insulation resistance between it and the earth or the other conductor, which in ohms shall not be less than 2,500 E in which E is the voltage of the generator or transformer; for making insulation tests the voltage shall be equal to that of the generator or transformer, but not exceed 500 volts or being less than 100.

Insulating Wires.—"Elec. Tech.," Aug. 31, mentions a process of Lefevre and Aron which consists in making a solution of rubber in benzine and paraffine or bisulphide of carbon; in this the wires which have been insulated with cotton are immersed, and then dried in the air; it appears that the wire should first be placed in a vessel from which the air is exhausted and then impregnated under pressure, in order to expel the air from the pores.

Cable Machinery.—Some illustrations of the large cable-making machines by Johnson & Phillips are illustrated in the Lond. "Elec. Eng.," Sept. 6.

Insulated Wires.—Mr. Dobbs, in the "Elec. Eng.," Sept. 18, discusses the different kinds of insulation for wires from a practical standpoint. He prefers weatherproof wire in dry places; the objection to rubber is not the price, which is nearly the same, but the fact that when exposed to air, or in dry, hot places, it has not the lasting qualities of the braided asphaltum kind; a wire that maintains an insulation of half a megohm for five years is better than one which starts at a much higher figure and falls to a very low figure during that time; asphaltum will not resist long-continued dampness, which, on the other hand, preserves rubber; when rubber can be kept away from the air it is the best insulation; in mouldings it lasts much longer than on cleats; he gives results of some observations with different wires in use. He concludes that an insulation composed of a light rubber core with two asphaltum soaked braids would make an ideal insulation for ordinary house wiring; if a rubber-core single-braided wire

is used, select one soaked in compound instead of shellac; never use wires with a tape winding on the outside as they never last, except in mouldings; if the insulation is rubber select one in which the core is made of two layers, then if one crumbles the other still protects; for cleat or concealed work in dry places use weatherproof wires; the same applies to conduit and double-tube work; he would pass anything that was placed in conduits, unless in damp places, and even then, if the conduits are iron-armored; the only danger of the Underwriters' wire is electrolysis, as he never knew it to make a short circuit.

ELECTRO-PHYSICS AND MAGNETISM.

The Induction Coil Spark.—Mr. Lebiez in "L'Elec.," Aug. 24, describes a phenomenon which he investigated and which was originally noticed by Du Moncel. If the two terminals consist of fine iron wires close together the spark will heat the negative pole to a red heat; only the end will be heated. The present writer describes some improvements made with the induction coil to increase its efficiency, which consist in reducing the resistance of the primary coil, making the resistance at the interrupter less and making the action of interruption more rapid by weighting the end of the hammer and limiting its motion. By using two wires of platinum 15 cm long and 0.5 mm in diameter, the negative one became heated for about 2 cm; the phenomenon is made more striking by using a fine German silver wire of 0.03 mm in diameter, to the end of which is secured a large wire of another metal 1 mm in diameter and 3 to 4 cm long, in which case the fine wire will hardly heat, while the thick wire will be raised to a white heat. The same phenomenon may be shown in a Geissler tube in which only the negative pole will be heated and even melted. He suggests that by this method it would be possible to heat to incandescence a filament of carbon producing an intense light; such a light was produced in the air by carbon rods 1 or 2 mm in diameter. No heating will take place if the wires touch; he thinks the most resisting part of the circuit is the layer of air around the pole, and that this air is therefore heated to a very high temperature; the fact that only the negative pole heats, he suggests, indicates that the current has a definite direction from the positive to the negative. He suggests that this may lead to a solution of the problem of lighting by electricity.

Experiments with Electromagnetic Mechanism.—Mr. McMahon's serial (see Digest, Aug. 3), is concluded in the Lond. "Elec.," Sept. 6. He gives the results of further experiments showing how the curves may be made to vary and to become straight lines by adjusting the spring and the position of the solenoid with respect to the movable core. These experiments show that with cores and solenoids the results are successful as regards sensitiveness, range and shape of curve, but weak as regards the turning moment, the weakness being due to the return path being through air. When this path was made of iron the action was sluggish. With closed magnetic circuit the results did not comply with the required conditions as set forth in the beginning (see Digest, July 20). A shuttle-wound armature with a large pole-piece forms an excellent piece of mechanism where a large range and strong pull are required. Other mechanisms are described and profusely illustrated, but cannot be described in abstract. In all experiments with a return magnetic circuit the mechanism was very sluggish, and as prompt response was one of the conditions sought for, he concludes that an open circuit is the most successful from every point of view. Such a mechanism is described and illustrated. It worked on the principle of decreasing the air gap by the deflected movable iron, the pole-pieces being so shaped that for each degree of movement of the armature the length of the air gap was decreased a proportionate amount; the curve is almost a straight line and could have been made exactly so by properly shaping the pole-pieces; he shows how the best eccentricity was determined and finds that a thick armature is better than a thin one. The results following his experiments are summarized briefly in a table. In concluding he states that the simple coil and solenoid is not at all suitable for long range combined with strength and sensitiveness when the weight of the core is supported by the magnetic field; if a core and solenoid is used it seems that the circular-shaped cores and short coils are the more satisfactory, but to obtain a long range a long core is necessary, and when curved and moving around the centre it acts as a heavy fly-wheel, and is therefore not dead-beat. A closed magnetic circuit makes mechanism sluggish; the mechanism which embodies all the desired conditions, namely, maximum range, strength and sensitiveness, is that with an open magnetic circuit and eccentric pole-pieces.

Magnetic Field of a Rectangular Current.—The Lond. "Elec.," Sept. 6, contains a short article by Prof. Minchin in which he deduces a simple expression "for the magnetic force per unit pole at any point in the plane of a given rectangle when this rectangle is traversed by an electric current." He first assumes the point to be outside of the plane and deduces the expression for the solid, or conical, subtended angle and from this he finds the expression if the point is infinitely close to the plane. Let two lines be drawn through the point in the plane and parallel to the sides of the rectangle, connect the ends of these lines, forming a quadrilateral and draw perpendiculars from the point to these last named lines, then "the value of the magnetic force intensity" at the point is equal to the current multiplied by the sum of the reciprocals of the lengths of these perpendiculars; so far as he knows this is the first publication of this simple result; it is obviously supposed that the point is at least so far from the wire that the diameter of the wire may be neglected, the wire being assumed to be a mere line. He explains a graphical method of making the calculation, which avoids reciprocals.

Resistance of Bismuth.—An abstract of some length of the paper by Profs. Dewar and Fleming, abstracted in the Digest last week, is published in the Lond. "Elec.," Sept. 6.

Conductivity of Heated Gases.—According to the Lond. "Elec.," Sept. 6, Dr. Pringsheim in a Berlin Physical Society paper, gave the results of experiments made with gases heated to 900° C.; he found that there was considerable polarization which was quite perceptible for fully half an hour after the current was broken; he reached the conclusion that conduction in heated gases is an electrolytic phenomenon.

Zigzag Wave E. M. Fs.—The "Phys. Rev." for September-October contains a mathematical article by Mr. Rimington in which he investigates the current in the limiting case of a pure zigzag E. M. F.; he does not use the Fourier series but adopts the "piecemeal" method. He works out an example in which the resistance is one ohm, the self-inductance 0.01 henry, the maximum E. M. F. 20 and frequency 100, and finds that the current in this particular case resembles a sine curve; with less inductance, however, it will become more pointed; the maximum current was 2.474 and the virtual current 1.798, while with a sine function E. M. F. having the same maximum voltage, these two currents are 3.145 and 2.223. He also considers the other limiting wave type, namely the rectangular form, and finds that the two currents are then 4.898 and 2.851; the current curve is nearly a true zigzag in that case; with a sine E. M. F. the maximum and virtual currents, therefore, lie between those of these two extreme cases.

Electrolytic Conductivity of Concentrated Sulphuric Acid.—The "Phys. Rev.," for September-October contains a paper by Dr. Guethe and Mr. Brigg; they give the results of a large number of measurements at a concentration of about 84.5 per cent. including the changes produced by temperature. They find that it is not the concentration but the molecular volume which determines the conductivity of the acid. Plotting the temperature and the specific conductivity, they find that the latter increases slowly at first but more rapidly the higher the temperature; between 0 and 7.5° C. this increase is enormous, but the conductivity of crystallized acid does not reach that of the liquid; at the latter temperature it was 28.44 while that of the liquid was 65.4; the increase in conductivity in changing from the solid to the liquid seems to have some relation to the energy taken up during the liquification.

Magnetic Storms and Sunspots.—A paper by Mr. Veeder, which was read at the Springfield meeting of the American Association, and which shows the connection between magnetic storms and sunspots, has been received. It contains a table, the data in which was taken from tracings recorded at the Naval Observatory in Washington; the instrument records photographically an irregular line representing the terrestrial magnetism and another line giving the time. Importance is placed on the method of tabulation used and which yields affirmative results, giving also an idea of the variations at different seasons; if arranged differently, or if the presence of the spots is taken elsewhere than at the eastern limb, the conformity in the groupings disappears; the table is said to embody all the evidence to be had in regard to the connection between the two phenomena; the table is claimed to be authentic beyond dispute. Storm intensifications seem to occur in connection with the solar conditions attending electromagnetic effects.

Hysteresis Compensator.—The "Elec. Eng.," Sept. 11, contains a brief description with illustration of Abdank's compensator, which was described and illustrated in the Digest, Oct. 7 and 28, 1893; (another form was described in the Digest, Nov. 25, and compared with this one Dec. 16, 1893).

ELECTRO-CHEMISTRY AND BATTERIES.

Electricity Direct from Coal.—The "Elek. Zeit.," Aug. 29, contains a short paper by Dr. Schmidt in which he reviews briefly the various methods. In thermopiles the heat conductivity of the metals is so great that by far the largest part of the heat is conducted away and is lost; it is for this reason that it is doubtful whether much will ever be accomplished with this apparatus. Carbon may be burnt directly in a battery as a negative electrode, but he says that this is accomplished only at a red heat, thus requiring internal heat; besides this the materials for supplying the oxygen are too expensive. Another method is to use such materials in primary batteries, the final products from which can easily be reduced to the primitive materials by means of heat; zinc is not satisfactory for this material—iron is much better; some years ago a patent was taken out in France for a cell consisting of iron and carbon in a solution of carbonate of sodium, the iron being converted into carbonate and the hydrogen is converted into water by the addition of air on the surface of the electrode; the cell is not practical, however, on account of the depolarization by means of the air, but the carbonate of iron is readily reduced again in a furnace; for a practical form of cell electrodes should be used whose external form is not changed and which after discharging can be regenerated in the cell itself or in any other convenient way. As a carrier of the oxygen of the air a large number of substances may be used; there are solutions of metallic salts which readily absorb oxygen and give it off at the positive electrode to combine with hydrogen, but the use of liquids introduces

the objectionable diaphragm; among solid bodies the best is probably spongy copper which oxidizes in the air or can even be regenerated in the cell itself by passing air over it. Several propositions have been made for the negative electrode; iron can be converted into its oxide in alkaline solutions, the oxide adhering to the metal and being easily reduced in a furnace; Borchers used copper impregnated with carbon monoxide, which (it was claimed) was burnt into the dioxide. A better efficiency than the 30 per cent. obtained (?) by Borchers can be gotten by burning iron in the cell and reducing the oxide in a furnace. All such researches have shown that the smaller the absolute amount of heat which is set free in a cell, the larger the electrode must be made in order to reduce the resistance losses, and a voltage of 0.5 was obtained with a current density not greater than four to five amperes per square mile, from which it follows that the dimensions of such an apparatus would be enormous and the primary cost prohibitive; but there is no reason to suppose that improvements would not be made in this direction. He then mentions a process for generating electricity in a cell by the direct application of heat; in place of the chemical reaction in a cell it is possible to generate a voltage by heating one of the electrodes. If, for instance, there are two copper plates in a voltameter, one of which is heated, calculation shows that for a difference of temperature of 80° there will be generated 0.01 volt. To use this combination would be impracticable owing to the transference of heat by the liquid and the size of the plates, but it may be possible to find some material which at a low temperature will be decomposed with as great an absorption of heat as possible and the product of which will generate electricity in the cell; this would be the ideal form. Results so far obtained in the generation of electricity direct from coal he considers very encouraging.

In the "Elek. Zeit.," Aug. 22, Mr. Vogel states that in the recent discussions of this subject sufficient notice is not taken of earlier researches in this direction. He calls attention to the work of Bartoli and Papasogli who found that carbon in sodium and potassium hydrate is negative to platinum and generates a voltage of 0.1 to 0.18; in hypochlorites they obtained by the cold combustion 0.4 to 0.55 volts; they used retort carbon or natural, pure graphite; their researches were published in the "Nuovo Cimento," vol. 12, 1882, page 141. One of the most important points in this discussion is that the product of the cold combustion was neither carbon monoxide nor dioxide but was an oxidation of the materials which they used; it is therefore quite questionable whether carbon can be completely burnt to give off the oxide, at ordinary temperatures, even by means of the nascent oxygen.

In a long communication by Prof. Bucherer in the "Elek. Zeit.," Sept. 5, he replies to the recent discussion by Dr. E. (see note below) of his Franklin Institute paper, which was mentioned in the Digest, April 6 and May 18. The object of his original paper (ELECTRICAL WORLD, April 6, p. 416), was to prove the opinion that Borchers' experiments must be considered as failures; Bucherer showed that from the observed E. M. F. it follows that no electrochemical union of carbon monoxide and oxygen can take place, and it follows that there is no other source of energy than the copper electrode. He shows that the chemical equations given by Borchers are not correct; he questions whether Borchers or anyone else has ever observed the evolution of carbon dioxide from a hydrochloric acid solution of cuprous chloride combined with carbon monoxide; such a reaction as this does not exist; in ammonia solutions the affinity of the ammonia enters; neither is the original equation an electrochemical one; he describes briefly the experiments of Mond; he shows that Borchers could not have considered the point brought out by him (Bucherer) in that paper.

E. M. F. in Electro-Chemical Processes.—A paper from the German, by Mr. Quincke, is abstracted briefly in the Lond. "Elec.," Sept. 6. He shows that there is a wide discrepency between the theoretical and the actual E. M. F. required. In the electrolysis of sulphate of copper, for instance, when applied to ores, the ore may contain iron and may be partially decomposed, producing sulphuric acid and oxygen, the copper may be deposited more rapidly than it is extracted; uncompensated losses occur from the oxidation of oxidizable salts; 20 per cent. of the current may be spent in producing per-sulphuric acid, or there may be a wasteful evolution of hydrogen. In the production of chlorine by electrolysis of hydrochloric acid only 50 per cent. of the energy is used, so that it requires 6.5 times the weight of coal to produce the same quantity of chlorine as in the Deacon process. A great saving could be effected if the hydrogen developed could be combined with oxygen to produce electrical energy; he considers the invention of a practical gas battery, which could be fed with air and produce gas, a matter of great importance.

Electricity Direct from Coal. Errata.—In the Digest, Sept. 7, under this heading, there is an article, which, by mistake is attributed to Dr. Garnier while it should have read Dr. E. The abstract, furthermore, should have been above the dash instead of below it. At the end of this paragraph a reference is given to a translation of a paper by Mr. Garnier; this belongs to the article by that author, a few paragraphs above, on "Action of the Current on Fused Sulphides."

Action of the Current on Fused Sulphides.—A translation of the complete paper by Mr. Garnier, which was abstracted in the Digest, Sept 7, is given in the "Elec. Eng.," Sept. 11. The reference in the Digest, Sept. 7, to another publication of this translation, was by error added to the abstract on "Electricity Direct from Coal."

Commercial Production of Oxygen and Hydrogen Gases.—"La Nature," Sept. 7, contains a short article by Mr. Buono in which he states that an installation has been started in Naples for the commercial production of oxygen and hydrogen gases by means of electrolysis; the results are said to be satisfactory; the gases are used for various purposes such as the production of light, fusion of metals and glasses, welding of metals, etc. One cu. m. of mixed gases is obtained for every 2,600 watt-hours; a candle-power of light is obtained for every four fifths of a liter of the mixed gases; the cost of the electrical energy is less than that charged for lighting from central stations, as the load is a constant one. The Italian minister of war intends to use this gas as a combustible in the rifle factory at Terni. It is also suggested that a motor driven with these gases would solve the problem of traction, as enormous quantities can be stored in a small volume; oxygen can be furnished at much less than $1 to $1.20 per cb. m, at which price it is at present sold by others using the old process. A note by the editor states that he leaves the responsibility of the statements to the author.

Chloroform.—According to a note in "L'Elec.," Aug. 24, chloroform may be made in enameled vessels with a double bottom, heated by steam and containing two electrodes of lead; it is filled with a 20 per cent. solution of salt to which is added acetone, while the current is passing; the chlorine produced reacts on the aectone forming chloroform which is collected by distillation; for 100 parts by weight, of acetone, 190 parts of absolutely pure chloroform are obtained.

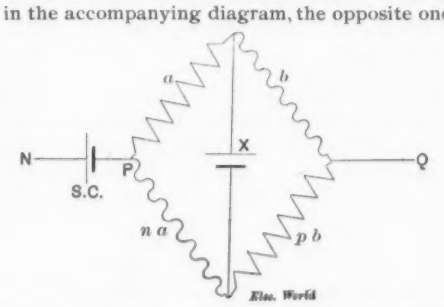
Resistance of Accumulators.— In the Lond. "Elec. Rev.," Sept. 6, Mr. Allingham in referring to a recent statement by Mr. Fitzgerald (see Digest, Aug. 31), that the internal resistance of a cell is simply the resistance of an electrolyte, asks whether this is known to be the case; during the discharge of an accumulator the internal resistance increases to several times its original value, an increase which is far too great to be accounted for by the increased resistance of the acid; if the distance between the plates is increased the internal resistance will be increased, but in a much smaller ratio; apparently a large part of all the internal resistance is in the nature of a contact resistance at the surface of the plates, and this he believes will surely be increased greatly by enclosing them in closely fitting perforated envelopes.

Retaining Cells for Accumulators.—"Elec. Tech.," Aug. 31, speaks very favorably of cells made of a material called "Ambroin," which consists of copal resins mixed with some fibrous materials. The material does not appear to be attacked by boiling water or acids; its specific gravity is 1.4; it is sufficiently strong to enable the jars to be made thin; small jars may be made without a seam by means of pressure while hot, while large ones can be made of pieces joined very perfectly with each other.

Copper-Zinc Accumulators.—Mr. Commelin, in a communication to "L'Elec.," Aug. 24, states that what is known as the Waddell-Entz accumulator is simply a copy of the Commelin-Desmazures; in the latter a copper paste is put on a metallic gauze made of copper, while in the former the gauze is made of brass.

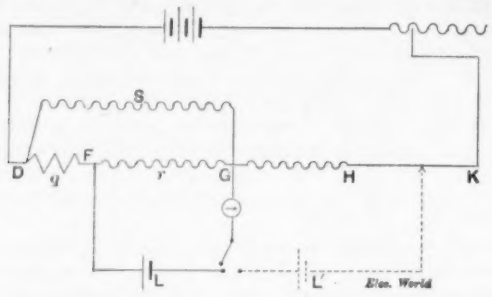
UNITS, MEASUREMENTS AND INSTRUMENTS.

Self-acting Temperature Compensation in Standard Cells.—The Lond. "Elec.," Sept. 6, contains an article by Mr. Campbell in which he suggests three methods and discusses the best conditions analytically in each case. In the first method the standard cell is placed in series with two high resistances made of materials having different temperature coefficients; he shows that by properly choosing the materials and the magnitudes of these resistances the difference of potential on one of these can be rendered nearly independent of temperature. The circuit of the standard cell in this case is closed through this resistance; the serious objection is that unless they are very high the internal resistance of the cell will not be negligible and the cell will polarize; the other two methods are free from these defects. In the second method four resistances are connected as in the accompanying diagram, the opposite ones being made



of the same material, a and $p\,b$ varying with the temperature while the other arms are practically constant; X is a Daniell, Leclanche or other auxiliary battery whose E. M. F. is known within about 5 per cent. and which will keep fairly constant on a high resistance; $S\,C$ is the standard cell and its variations are compensated by adding or subtracting automatically a small fraction of the E. M. F. of the auxiliary cell; if the bridge is balanced the voltage between N and Q would be that of the standard cell, but if by change of temperature it is not balanced a fraction of the voltage of the auxiliary cell will be added

or subtracted; the conditions are investigated analytically and an example is worked out. In the third method the current from an outside source passes through two resistances in series, one of copper or nickel and the other of manganin, both of which are shunted in common by another resistance of manganin; it is possible to choose the values of this resistance so that "the current can remain absolutely invariable and yet produce" between the ends of the first manganin resistance "a potential difference exactly equal to the E. M. F. of the Clark cell and having the same temperature variation." The method is best used with a potentiometer, as shown in the accompanying figure where



$G\ H\ K$ is the potentiometer wire, q, r and S are the three resistances, adjusted so that the sum of r and S is equal to four times q, the former being of manganin and the latter of copper, so that when the voltage between F and G is just balanced by the Clark cell a current from G to K will be just the right strength to make the potentiometer read directly in volts; the final adjustment is made once for all, as follows: notice the temperature and let the corresponding E. M. F. of the Clark cell be e; adjust the current until the Clark cell balances when in the position shown in dotted lines, the potentiometer reading being equal to e; then slightly alter the position of the junction at F until the cell balances when shifted to the position L, in which position the cell is kept permanently; to use the potentiometer it is then necessary only to adjust the current until the Clark cell balances at F and G; the potentiometer will then read directly in volts and be independent in temperature to the third place decimals. He adds that the standard cell and the compensating coils should, if possible, be in the same case, so that all may be at the same temperature, and that the copper or nickel resistance be of such a mass as not to heat appreciably by the current. (The letters F, q and r are omitted by mistake in the original cut, but there is little doubt that they are inserted here correctly.)

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone Newspaper.—Some further information regarding this novel enterprise is given in the Lond. "Elec. Eng.," Sept. 6. It refers to a system of distributing news which has now been in successful operation in the city of Budapest (Hungary) for over two years, and was described in the Digest, March 18, Nov. 4 and Dec. 30, 1893; news is distributed from a central station throughout the whole day, by means of telephone. It is stated that this telephone newspaper has now become almost indispensable and the telephones are to be found everywhere, as, for instance, in waiting rooms, in barber shops, restaurants, offices, private houses, etc.; news is sent out in strict accordance with a programme, so that each person knows when the turn will come for the news in which he is interested. The main office is in telephone communication with the Reichstadt (corresponding to our Congress), and it often happens that important speeches are known to the public while the speaker is still addressing the House; the latest reports from stock exchanges, as well as foreign political news are heard before any paper has printed them; a short summary of all important items is given at noon and again in the evening; subscribers are entertained with music and literary articles in the evenings; the latter being often spoken into the telephone by the original authors; the cost is only 2 cents a day, the wire and apparatus being installed free, providing the subscriber binds himself for one year. The company started with a capital of $120, 000, but have now invested $200,000; before any news is imparted a shrill, trumpet-like blast is sent through the circuit, which is said to be audible in the whole room of a subscriber; 6,000 subscribers are served by one wire 168 miles long.

Long-Distance Telephony.—A German translation of the article by Mr. Collette (see Digest, May 4), is being reprinted in "Elek Zeit.," beginning with issue of Aug. 29.

Electrical Communication with Lightships.—The Lond. "Elec. Rev.," Sept. 6, abstracts with some illustrations the patent of Smith, 1892, and another of Blake, 1894, both for induction systems.

Struggle between the Telegraph and Telephone.—In the "Elec. Eng.," Sept. 11, Mr. Delaney discusses the relative merits and possible future field of the telegraph and telephone. If both continue to grow in the same ratio as in the past it will not be long before the telephone is greater than the telegraph in property and earning capacity; the telephone has been managed with energy and enterprise, while the telegraph has been confined to old, conservative grooves. In the United States there are carried about 40 letters to one telegram; although few speakers will average 150 words a minute he thinks that 60 words a minute is a very liberal rate for the telephone; a quadruplex will carry 60 words per minute over one wire; the cost of 300 words typewritten by telegraph at regular rates would be $9.10 between New York and Chicago, which is only 10 cents more than the telephone charge for five minutes, showing that the telegraph and telephone are about on a level at present, but the telephone has insuperable advantages in completing a conference on the spot. The telegraph is infinitely more resourceful; with the present system only 5 per cent. of the carrying capacity of the wires is utilized but there is no such possible room for improvement in the telephone, the speed of which is limited; when telegraphy is broadened to its proper function he believes the mails will be carried by it at a rate of 90 cents for 300 words as against $9 for the telephone message, which, in addition, requires two wires; it is practicable to send 1,000 words per minute over an 850-pound per mile copper wire from New York to Chicago; he thinks automatic machine telegraphy with chemical recording will carry the bulk of the correspondence, which is too urgent for railway transportation and not urgent enough for the telephone.

Telephoning in the Country.—In a short article, by Mr. Dommerque, in "Elec. Eng'ing" for September, he states that the cost of running two wires is almost prohibitory, while a grounded line would not answer for such long distances; he mentions that one pair of wires can now be made to serve twelve subscribers, with which system the service can be given for 4 cents a call, assuming that there is at least one call a day.

Telephone.—An illustrated description of the Mercadier and Anizan combined urban and long-distance telephone, is published in the "West. Elec.," Sept. 14; it is the same device which has been described and referred to several times in these columns.

MISCELLANEOUS.

Multiple-Copying Process.—A process by means of which any number of copies may be made of matter written by hand, is briefly described in the "Elec. Tech.," Aug. 31. The pen used consists of an iron point which is kept hot by means of an electric current from a battery; with this, one writes on a piece of Japanese paper covered with a sheet of wax; this is then used as a stencil, with which any number of copies may be printed.

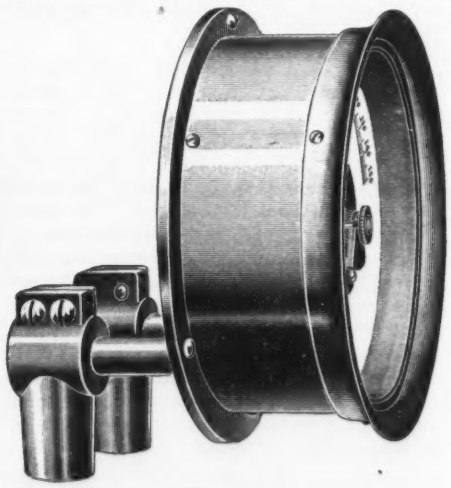
Report of the Annual Meeting of German Electricians.—The "Elec. Zeit.," Sept 5, contains a report of the proceedings of that meeting; most if not all of the papers were published separately and have been abstracted in the Digest.

Electricity as the Medium of Transmission in the Brain.—An article, by Dr. Miller, from the "New Science Rev.," is reprinted in the "Elec. Rev.," Sept. 18.

Improved Norton Switchboard Instruments.

The accompanying engravings show the latest product of Charles E. Norton, of Manchester, Conn., in the way of switchboard instruments. The instrument illustrated is an ammeter, and though the general appearance will be familiar to most readers, the instrument has been much improved as to its interior construction.

Fig. 1. Norton Ammeter. Fig. 2.



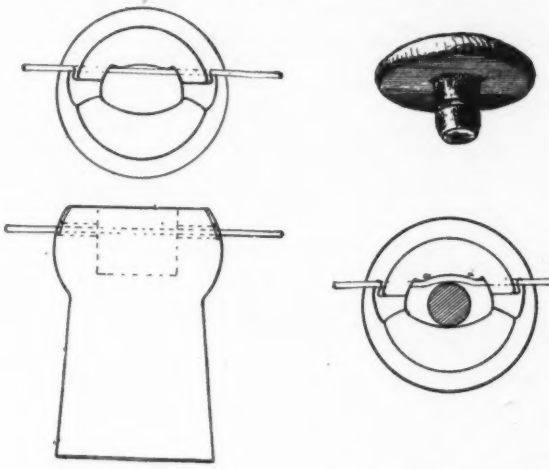
Both the ammeter and voltmeter are accurate and reliable for the practical work for which they were designed, and the manufacturer claims for them great durability and constancy. The voltmeter is so constructed that the scale divisions are the widest in the region of the E. M. F. at

which the line is worked, and it may be left in circuit indefinitely without fear of overheating or having its accuracy impaired.

These instruments are mounted in handsomely-lacquered brass cases of substantial construction, and are furnished with either regular binding-posts or back connections, the latter type being shown in Fig. 2. As will be seen from inspection of the cut, the back connections are unusually massive so as to avoid heating and ohmic losses due to poor contact or insufficient cross-section. Another advantage embodied in the type of connection used consists in making the connecting lugs separable from the conducting rods leading into the instrument.

A New Insulator.

We illustrate herewith a new form of insulator for which a patent has been granted to Albert Vickers and Wm. Dibb, of Syracuse, N. Y., and which is manufactured by the Noti Insulator Company, of the same place. The insulator is designed to do away with tie-wires, and is very simple and cheap. The trouble with the present form of insulator, necessitating the use of a tie-wire, is appreciated by all telephone and telegraph construction men. The theoretically perfect way of suspending a wire is to rest it in a perfectly smooth saddle of glass or porcelain not in contact with any other wire or metal liable to cause corrosion and mechanical injury to the wire. The only difficulty in carrying out this idea seemed to be the provision of a practical method of anchoring the wires to each insulator. It was with this end in view that the insulator here described was devised. The wire rests easily in a cavity in the top of the insulator and is held firmly, but not jammed, against one wall of the cavity. It is in contact with nothing but smooth, rounding surfaces of glass or porcelain; there is no chance for abrasion or mechanical injury, and the wire is securely anchored.



FIGS. 1 AND 2. FIGS. 3 AND 4.
NOTI INSULATOR.

The lower part of the insulator is of the ordinary pattern, screwing to the pin, except that a less number of threads may be employed, as the insulator cannot unscrew. The top of the insulator is provided with a cavity shaped as shown in Figs. 1 and 2, and two opposite recessed slots. A cylindrical plug slightly tapered, as shown in Fig. 3, is provided of same material as the insulator, and of a diameter less by the thickness of the wire used than the greatest width of cavity.

The wire is laid in the slots and plug pushed home until the groove in plug comes opposite the wire, thus crowding the wire slightly against the wall of the cavity. It will be seen that with plug in position, the wire cannot be withdrawn in any direction, cannot fly up, and the resistance to lateral pull is enormous. In experiments made by cutting the line wire close to the insulator it is stated that the wire beyond did not slip a particle, and during a six months' test, leaving one inch of wire beyond the insulator, the wire has not moved. The principle of the insulator can be better seen in Fig. 4, and depends on the roller action of the plug against the narrowing sides of the cavity, binding the wire tighter as the endwise pull increases. It is almost impossible for the plug to come out unless intentionally removed, as the bearing of the wire against the groove in the plug serves to keep it in place.

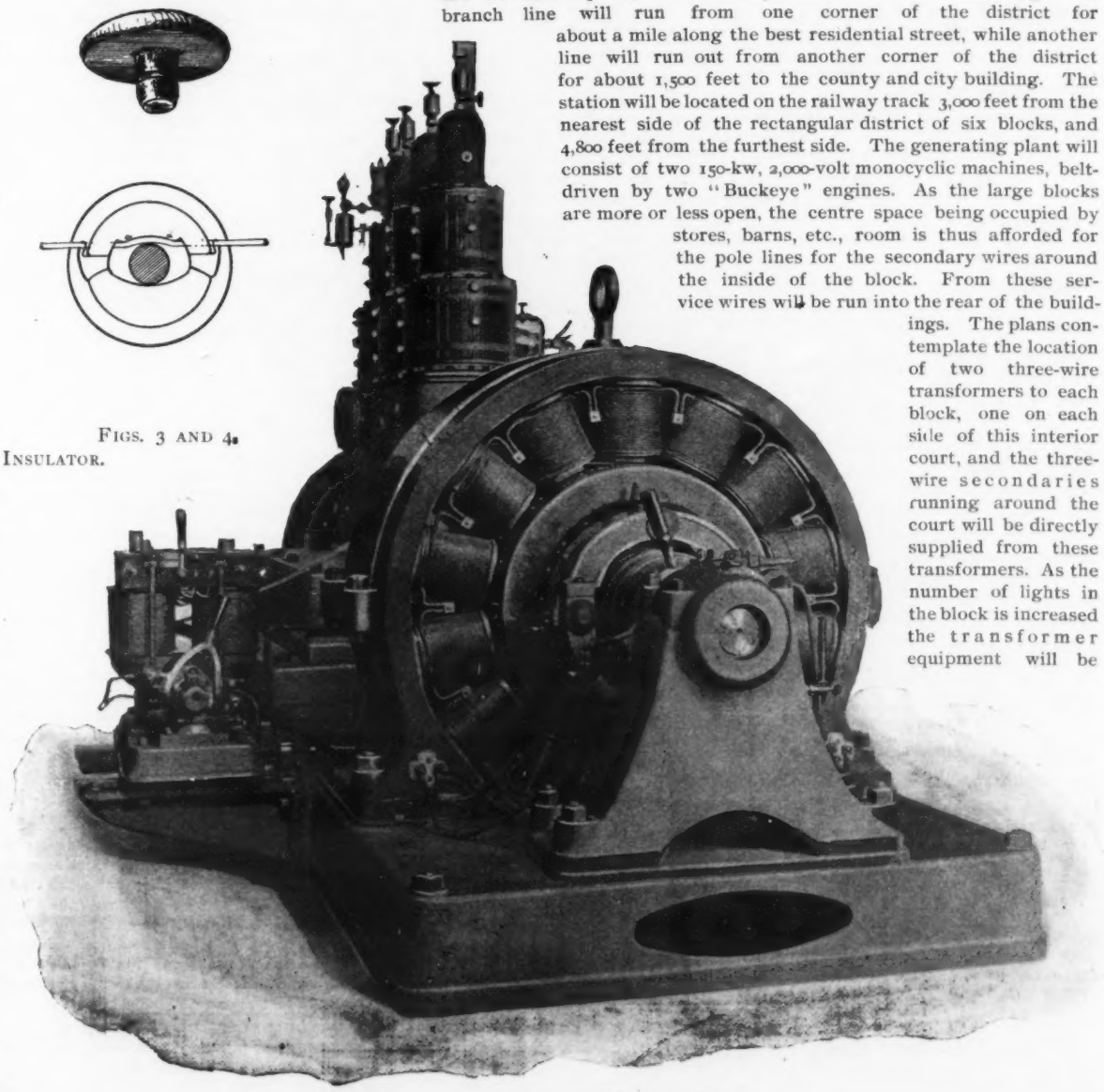
Monocyclic Apparatus.

The accompanying engraving represents an interesting direct-connected generating set built by the General Electric Company for the Chicago Lake Street Elevated Railway Company. The engine is a Willans central valve single-acting, of 150 indicated horse-power capacity, and the generator is a special monocyclic machine of 140 kw capacity, embodying the best features of modern dynamo construction.

The armature core is built up of insulated laminations and is provided with ventilating ducts through which the air may rapidly circulate. The coils are made up separately and any one of them can be readily removed from the armature without disturbing the other coils. The pole-pieces are built up of laminations of sheet iron and cast into the frame of the machine to eliminate eddy currents in the pole-pieces and lower the magnetic reluctance of the field circuit. The bearings are self-oiling, self-aligning, and are designed with ample surface to secure cool running.

Automatic regulation is secured to meet varying conditions of load by rectifying a portion of the main current and passing it through a supplementary field winding.

A monocyclic central station is about to be built in Salt Lake City, the distribution being made on the three-wire secondary method from large transformers. Most of the lighting will be confined to a space covering about six blocks, and as the blocks in Salt Lake City are 800 feet square, the territory covered is somewhat large. A branch line will run from one corner of the district for about a mile along the best residential street, while another line will run out from another corner of the district for about 1,500 feet to the county and city building. The station will be located on the railway track 3,000 feet from the nearest side of the rectangular district of six blocks, and 4,800 feet from the furthest side. The generating plant will consist of two 150-kw, 2,000-volt monocyclic machines, belt-driven by two "Buckeye" engines. As the large blocks are more or less open, the centre space being occupied by stores, barns, etc., room is thus afforded for the pole lines for the secondary wires around the inside of the block. From these service wires will be run into the rear of the buildings. The plans contemplate the location of two three-wire transformers to each block, one on each side of this interior court, and the three-wire secondaries running around the court will be directly supplied from these transformers. As the number of lights in the block is increased the transformer equipment will be expanded. For lighting the residential districts from the branch lines the usual course of using small transformers will be followed as far as possible. Motors are to be connected at once as required, a small third wire being introduced only for motor work.



MONOCYCLIC GENERATOR AND WILLANS ENGINE.

A 150-kw monocyclic generator, with all necessary station accessories, will soon be installed in the works of the Carnegie Steel Company.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 21, 1895.

THE ELECTRICAL STOCK LIST reflected the revival of the industrials this week, almost the whole line displaying a marked increase in strength as compared with prices of the past several weeks. American Bell, Erie Telephone, New England Telephone and General Electric all manifested bullish tendencies toward the close of the week, and the general feeling on the Exchange floors more nearly approaches the steadiness and confidence which characterized ante-depression days than at probably any period since the collapse two years ago.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	98	100
" " " Brooklyn	100	110	115
" " " Boston	100	150	..
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	46⅝	46⅞
General Electric	100	30	39½
General Electric, pref	100	69	70
Westinghouse Consolidated, com	50	35½	35¾
" " pref	50	55	..

BONDS.

Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	200	..
American District Telegraph	100	35	40
American Telegraph & Cable	100	93	96
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	64	64½
Gold & Stock Telegraph	100	105	..
New England Telephone	100	90	..
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	92⅞	93

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	19¼	19½
Binghamton RR. com	100	100	..
Brooklyn Traction	100	13	15
" " pref	100	61	64
Buffalo St. Ry	100	85	87
Cleveland City Ry	100	69	70
Cleveland Electric Ry	100	59	60
Columbus St. Ry	100	55½	57
Consolidated Traction of N. J	..	25	..
Electric Traction, Philadelphia	50	73	73½
Hestonville	100	56	58
Long Island Traction, all pd	100	19½	20
Louisville St. Ry. com	100	37	39
" " " pref	100	87	88
New Orleans Traction	100	21	23
" " pref	100	74	76
North Shore Traction	100	35	37
" " pref	100	86	88
People's Traction $30 pd	25	64¾	65
Philadelphia Traction	50	84¾	85
Rochester St. Ry	..	..	39
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	73½	73¾
" " pref	100	93	94
Worcester Traction	100	18	19
" " pref	100	87	89

BONDS.

Buffalo St. Ry. 1st con. 5s	100	108	109
*Binghamton Railway Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	101	103
Rochester St. Ry. 1st 5s	100	105½	106½
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Div.

THE TRACTIONS.—Baltimore Traction has had a slight reaction recently, selling down as low as 18 at the first of the week. Later it rallied and held the advance to the closing. Buffalo Railway stock, after selling at 84, advanced rapidly to 86, and sales are reported at about that figure. Some large blocks of this stock are said to have been sold abroad lately, and as the floating supply of this stock has always been more or less limited, its recent rapid advance is not hard to account for. Brooklyn Traction, both common and preferred, was offered down during the early part of the week to 13 and 60, respectively, but on the publication of the August report to-day, both classes of stock advanced sharply. At the close 13½ was bid for the common and 61½ for the preferred. The gross earnings for the month of August amounted to $117,288, an increase of $5,768, while the net gain was $3,729. The company expects to show increased earnings from this time on, now that the effects of last Winter's strike have worn off.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Sept. 23, 1895.

THE J. H. M'EWEN MANUFACTURING COMPANY, builder of high grade automatic engines, has opened an office at 1208 Havemeyer Building, in order to facilitate the handling of its greatly increased business in this vicinity.

MR. HERBERT T. RICHARDS, who is well known and popular in electrical circles, recently accepted a position with The Safety Insulated Wire & Cable Company. Mr. Richards' many friends will join in wishing him success in his new field of labor.

FLEXIBLE MICA PATENTS ALLOWED.—The board of appeals of the United States Patent Office has just reversed the decision of the primary examiner, and granted the right to protection upon what is known to the trade as "flexible mica," an insulation recently introduced by the Mica Insulator Company, of 213 Water Street.

INDUSTRIAL RAILWAYS are coming more and more into favor as their advantages are made evident. The Ansonia Brass & Copper Company, Ansonia, Conn., now uses industrial railways of 21½ inches gauge, designed by the C. W. Hunt Company, of 45 Broadway, and the Thorndike Company, Thorndike, Mass., has also installed the Hunt system of narrow-gauge railways for handling materials in its works.

ELECTRICAL WORKERS' UNION No. 22 has elected J. J Dooley, president; S. Lyckholm, vice-president; J. Kerns, recording secretary; W. J. Watters, financial secretary, and J. Brinkman, treasurer. Union No. 47 has elected E. C. McCarty, president; A. E. Gibbons, recording secretary, and W. H. Nichols, financial secretary. Union No. 32 has elected J. F. Colvin, president; Joseph Maher, recording secretary, and John Kane, financial secretary.

WILLIAM L. STRAUSS & CO., 27 Warren Street, have been appointed sole agents for this country for the sale of the celebrated high-grade carbons manufactured by Dr. Albert Lessing, Nuernberg, Germany. Although these carbons had been thoroughly introduced in all parts of the world, Mr. Strauss, before closing the matter, submitted samples for test to some of the most prominent central stations in this country, and the agency was accepted upon the strength of the favorable reports received.

RAINBOW PACKING continues to add to its already enviable record. The Peerless Rubber Manufacturing Company, of 16 Warren Srreet, has just received the following letter from Chief Engineer Henry J. Reynolds, of the steamship *Northland*, of which President Dale is justly proud: "I have used 'Rainbow' packing for steam and hot water pressures of 266 pounds and 500 to 600 pounds, respectively, and find it superior to all others. Before using Rainbow I tried various other packings, and found that they would not hold. I therefore tried 'Rainbow' packing, and can cheerfully recommend it as being the only packing for all high pressures in the market to-day."

A NEAT REMINDER is being sent out to the trade by Eugene Munsell & Co., 218 Water Street, in the shape of a commutator-insulating segment stamped from solid sheet mica, and provided with a brass loop for hanging up the segment, which the recipient is requested, by a legend printed in gilt on the mica, to do. The suggestion does not stop here, however, but continues: "and when you need stamped solid sheet mica segments send to Eugene Munsell & Co.," giving the address. This enterprising concern has met with such signal success in the production of high-grade mica for electrical purposes that it has been compelled by sheer volume of actual business to add 2,600 square feet to the factory and put in three new presses. A most complete stock of mica is carried constantly on hand so as to enable the firm to fill orders promptly.

MR. W. T. OSBORNE, of the firm of W. T. Osborne & Co., Kansas City, was a visitor in New York last week. Mr. Osborne, who makes it a rule to do well whatever he undertakes, has been spending a somewhat lengthy vacation in the East, visiting numerous Summer resorts and leading Eastern cities, and intends spending a day or two at all larger cities passed through on his return trip. Mr. Osborne is recognized as an active and successful business man, and is an able representative for Eastern houses fortunate enough to have him as Western agent. Some wiring contracts recently secured by his house are: State Capitol Building, Topeka, Kan.; Kansas City Public Library Building, Trust Building, Kansas City, and the Kumph Building, Kansas City, in which will be installed about 800 incandescent and 40 arc lights. Messrs. W. T. Osborne & Co. also sell the Fort Wayne Electric Corporation's apparatus, and have made "Wood" dynamos and transformers as familiar in Western territory as household words.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Sept. 20, 1895.

MILFORD, MASS.—A proposition has been made to the electric light company for power to run the cars from Milford to the top of Phipps Hill, in Holliston. A meeting of the electric light officials will be held at once to take action on the proposition.

THE SIMPLEX ELECTRICAL COMPANY has just been awarded the contract to furnish Simplex rubber-covered wire for the re-wiring of the United States Capitol at Washington, and General Manager J. H. Mason feels justly proud of his success in this connection, considering that this order constitutes an indorsement of the good qualities of Simplex insulation, as it follows a contract which his company filled last year for wires used in the new building for the Congressional Library.

CONNECTICUT'S REDUCED TELEPHONE RATES.—The action of the Southern New England Telephone Company in making wholesale reduction in prices has been a matter of interest throughout Connecticut since the announcement was made, about May 1, that it would take place. It is stated now that since the new rates went into effect 780 new names have been added to the list of telephone subscribers in the State, and that the company has been unable to keep up with the demand for new instruments. The company now has 6,446 telephones in the State of Connecticut, and has unfilled orders on file for 225 more, which will be installed as rapidly as possible.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Sept. 20, 1895.

MR. F. OVERBAGH, manager of the Chicago General Fixture Company, is on a business trip East.

THE SWARTZ METAL REFINING COMPANY has purchased the old electric railway at Fondulac, Wis.

MR. DANKNAR ADLER, contracting architect for the Crane Elevator Company, has left for Cleveland on a business trip.

MR. THOMAS G. GRIER, of Grier Bros., Western managers for the Bryant Electric Company, is recovering from a dangerous attack of bilious fever.

MR. F. E. RAINIER, Western manager for the Erie City Iron Works, has just sold to the Fox River Paper Company, of Appleton, Wis., three 600-hp and three 450-hp boilers.

MR. CHAS. E. GREGORY is away on a vacation to Channel Lake, Ill., and is feeling so well that on his return we may confidently look for a very choice line of fish stories at low rates.

THE FARR TELEPHONE & CONSTRUCTION COMPANY has closed a contract with Mr. George B. Hankins for 52 telephones for his big apartment house on Michigan Avenue.

MR. A. W. MORRELL, for the past three years chief electrician and mechanical engineer for the Lindell Railway, St. Louis, Mo., has resigned that position, and will engage in business for himself.

THE L. K. COMSTOCK COMPANY has just received work on the Ellicott Square Building and the Guaranty Building at Buffalo. The Ellicott Building will have a plant of 8,000 lights capacity. Baldwin engines and General Electric dynamos will be used.

MR. F. G. TALLMAN, manager of the Pittsburg and Chicago branches of the Brown Hoisting & Conveying Machine Company, of Cleveland, has just passed through Chicago on his way East. He reports a very great improvement in business at the Chicago office.

MR. J. C. BOSS, president of the Lakon Company, Elkhart, Ind., was married to Miss Annie Riddle, of Elkhart, on Wednesday last. The happy couple have the hearty wishes of a host of friends for a long and prosperous life, with all the felicity which their charming personalities deserve.

THE M. C. BULLOCK MANUFACTURING COMPANY has now under contract one 400-hp and one 200-hp central-valve engines for the Pabst Heat, Light & Power Company, of Milwaukee; also one 3,600-hp engine for the Terre Haute Electric Railway Company, all to be direct-connected. The company is also completing an order for six "Deephole" prospecting drills for Johannisburg, South Africa.

General News.

ELECTRIC LIGHT AND POWER.

ALBERT LEA, MINN.—The City Council has decided to put in 30 arc lights for street lighting.

HARRISBURG, PA.—Pennsylvania Steel Company will build a large addition to their electric plant.

GLADSTONE, MICH.—The city will issue $12,000 in bonds for the construction of an electric light plant.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power & Manufacturing Company will erect a power-house.

EMMETSBURG, IA.—The Council is considering a proposition from Walsh Brothers, of Burlington, to put in an electric plant.

ATHENS, GA.—The Athens Gas Light Company will make a proposition to the City Council looking to the sale of the arc and incandescent light plant.

WILMINGTON, DEL.—The directors of the Wilmington Light, Heat & Power Company have been directed by the company to proceed with the plans for erecting a plant.

BENNINGTON, VT.—The Bennington & Woodford Railway, which has been in operation for two months, has applied for right to extend its tracks beyond Main Street

WEST SCRANTON (SCRANTON), PA.—The question of establishing a new incandescent electric plant at West Scranton was discussed by the West Side Board of Trade.

JERSEY CITY, N. J.—The street and water board have directed Clerk Bouton to advertise for proposals for the street lighting of Jersey City for the fiscal year ending Dec. 1, 1896.

UNION SPRINGS, ALA.—The town of Union Springs desires to grant a franchise to responsible parties, to erect and to operate an electric light system. D. A. Sissiuns is mayor.

HEMPSTEAD, L. I., N. Y.—The Board of Trustees have let the contract to the Hempstead Gas Company to light the village streets with electricity. Philip J. Harper is secretary of the company.

BATAVIA, N. Y.—At the regular meeting of the Board of Aldermen it was decided to appropriate $1,000 for the purchase of an incandescent plant to be used for lighting the city building and hose houses.

BALTIMORE, MD.—Plans have been completed by Owens & Bieler for a power-house at Herring Run for the Chesapeake Electric & Water Company which has contracted to furnish electric lights and water supply at Canton.

GARRETT, IND.—The city of Garrett desires to put in water works and electric light plant and has adopted plans and specifications therefor. Detailed information will be given by C. L. McKibben, engineer, City Hall Building, Van Wert, O.

KNOXVILLE, TENN.—Sealed bids will be received by the Board of Public Works, at their office, until Oct. 19, for lighting the city by electricity with 200 arc lights, 2,000 cp each, all-night service, or on all dark hours' service. Contract to run for a term of 10 years.

BEATRICE, NEB.—The committee on lights have reported that the lighting contract between the city and the Rapid Transit & Power Company has been terminated, and recommended that the city clerk or committee on lights advertise at once for bids for lighting the city. The report was adopted.

LOS ANGELES, CAL.—A new electric light company has been organized by E. E. Peck, Station D, this city, with $80,000 capital subscribed. The company has put in some machinery, but the demand for lights is so great that a 60-kw alternator has been ordered and still more apparatus will be installed.

PORCHESTER, N. Y.—At a meeting of the Village Board of Trustees John W. Launsbury, president of the White Plains, Portchester, Rye & Harrison Electric Railway Company, presented a petition from his company asking for a franchise to build and operate a cross-county electric surface road, on Westchester Avenue in this village.

NEW YORK, N. Y.—Architect George A. Schellenger, 128 Broadway, is making plans for a residence for Spencer Aldrich, to be erected on the northeast corner of Seventy-second Street and West End Avenue which will be equipped throughout for electric lighting.

SUMMIT, N. J.—The parties interested in the electric light company which is to furnish Summit with electric lights, after Nov. 1, have decided to erect a plant on the banks of the Passaic River instead of upon the property of the Commonwealth Water Company, as originally intended.

HOMESTEAD, PA.—Sealed proposals will be received by the fire and light committee of the borough, until Sept. 28, for lighting the streets of said borough with 60 or more 2,000-cp arc lights, for a term of 10 years. For further details, address O. S. Swisher, chairman of fire and light committee.

ST. AUGUSTINE, FLA.—T. J. Appleyard and E. H. Hannon, representing the Jacksonville & Tampa Bay Improved Railway Company, are asking the City Council for a franchise for their company for electric light and power privileges. The company has secured a franchise for an electric street railway in St. Augustine, and desires to operate an electric light and power plant in connection with the railway.

GRAND ISLAND, NEB.—Sealed proposals will be received at the office of the commissioner of lands and public buildings, Sept. 27, for the installation of a complete incandescent arc and electric light plant at the Soldiers' & Sailors' Home at Grand Island. There is to be furnished one 20-kw direct-current compound-wound incandescent dynamo, of 110 volts, with switchboard, to contain all the necessary apparatus required for the successful operation of the plant; wiring for 250 16-cp lamps, all necessary fixtures, and two outside arc light lamps of 2,000 cp each.

THE ELECTRIC RAILWAY.

MERRILL, WIS.—The Merrill Electric Railway Company will enlarge its power plant. E. S. King is purchasing agent.

MEADVILLE, PA.—Dr. T. D. Lashells and others, of Boston, are interested in the construction of a street railway in Meadville.

OWEGO, N. Y.—F. E. Bard, of New York, is in town looking over the route of the proposed electric road between Owego and Speedsville.

ASBURY PARK, N. J.—Asbury Park & Belmar Street Railway Company proposes to build a double-track electric railway from Asbury Park to Belmar.

CHICAGO, ILL.—The directors of the West Chicago Railway Company authorized the issued of $1,000,000 7 per cent bonds to pay for electrical equipment.

MIDDLETOWN, CONN.—The Westport & Naugatuck Railway Company and the Norwalk Street Railway Company have filed an acceptance of their charters.

PITTSBURG, PA.—Pennsylvania Railway officials are said to be contemplating the equipment of the line from Union Station to Stewart Station with electricity.

FORT LEE, N. J.—John W. Ferguson, of Paterson, has been awarded the contract to erect a power-house and car shop at Fort Lee, for the Bergen Traction Company, to cost $50,000.

BALTIMORE, MD.—Bids will be received until Oct. 1 for a power plant for the Baltimore, Middle River & Sparrows Point Railway. Charles B. McLean, 304 Baltimore Street, is chief engineer.

RED BANK, N. J.—An ordinance has been passed granting to the Atlantic Highlands, Red Bank & Long Branch Electric Railway Company a location of its railway upon Red Bank and Eatontown Turnpike.

AUBURN, N. Y.—The Common Council has granted a franchise to the Auburn City Railway Company to construct its road to the second ward, and also to extend its tracks farther east in Genesee Street.

WHITE PLAINS, N. Y.—The New York, Elmsford & White Plains Railway Company has applied to the Board of Trustees of White Plains for consent to construct and operate a railway along various streets of the village.

LEROY, N. Y.—The board of directors of the Leroy & Northern Railway Company have petitioned the Board of Trustees for permission to build and maintain a single line of railway track upon the highways in the village.

OSWOSSO, MICH.—Alexander Ralph, who recently purchased the Owessa & Corunna Street Railway, is making arrangements to equip the road with electricity. He says he hopes to have electric cars in operation before Winter.

WASHINGTON, PA.—It is understood that the Washington Electric Street Railway Company contemplates an early extension to Canonsburg. Senator Kennedy, of Allegheny; Mr. Torrance and others, of Pittsburg, are interested.

ELLICOTT CITY, MD.—The Schafer-Nichols-Watkins Company, of Nashville, Tenn., contractors for the electric railway from Benzinger's Lane, Catonsville, to Ellicott City, have commenced the grading of that part of the road.

MINERSVILLE, PA.—The Schuylkill Electric Railway Company has awarded to P. F. Connell contracts for building two new trolley lines, one from Minersville to Taylorsville and the other from Pottsville to Schuylkill Haven.

PATCHOGUE, L. I., N. Y.—J. B. Swezie and Ex-County Clerk Orange T. Fanning, as a committee, are making every possible effort for the speedy culmination of the proposed Cross Island trolley between Port Jefferson and Patchogue.

COLORADO SPRINGS, COL.—The Colorado Automatic Telephone Company is taking steps toward the extension of its lines all over the State. It is the company's intention to establish a complete toll system between all the State exchanges.

LONG ISLAND CITY, N. Y.—The Steinway Railway Company proposes to extend its road from its present tracks at Newtown Road and Broadway, Long Island City, along Newtown Road to Jackson Avenue, to connect with the tracks on that avenue.

BUFFALO, N. Y.—The Buffalo, Gardenville & Ebenezer Railway Company has applied to the State Railway Commission for permission to construct a road, to be operated by electricity, four and one half miles long, to run from Buffalo to Gardenville and Ebenezer.

ALBANY, N. Y.—The railway commissioners have granted the Auburn Interurban Electric Railway Company permission to build a surface line between Auburn, Skaneateles, Port Byron and Weedsport. W. B. Goudell represents the present Auburn City Railway Company.

WASHINGTON, PA.—The Council has granted permission to the Washington Electric Street Railway Company to put up poles and string a feed wire along East Strawberry Alley, from the power house to Main Street. The work will be done under supervision of the borough engineer.

NEW HAVEN, CONN.—President Clark and the officials of the New York, New Haven & Hartford Railway are said to be considering the advisability of equipping the Warwick & Oakland Beach branch of the consolidated road with an electric system similar to that now in successful use on the Nantasket Beach line.

ELIZABETH, N. J.—The executive committee of the Board of Trade is negotiating with a syndicate with a view to the extension of the East Jersey Street horse-car line to Rahway and Summit, and the changing over to the trolley system. It is stated that about $300,000 will be spent in the undertaking.

NEW HAVEN, CONN.—The Middletown Street Railway Company, of which Israel Kelsey, of West Haven, is a leading official, has obtained permission to extend its lines to Cromwell, and work of construction will be started at once. The extension is to be three miles long and about $40,000 will be expended on the work.

PORTLAND, ME.—A special meeting of the Board of Trade and Aldermen ordered that the location of the Portland & Yarmouth Electric Railway Company be fixed and determined as follows, viz.: Beginning at the intersection of Elm and Congress Streets and running thence to the intersection of Oxford Street, etc.

KEENE, N. H.—An adjourned meeting of the incorporators of the Keene Electric Railway Company was recently held at the office of Hon. Charles Hersey and it was voted to commence as soon as possible the building of an electric road. The directors were authorized to make a contract for the construction of the line.

BUFFALO, N. Y.—The stockholders of the Buffalo, North Main Street & Tonawanda Railway Company have filed with the county clerk notice of their consent to mortgage the company's property for $75,000. The money is to be used to cancel a floating debt and to provide for future extensions and additions to the company's equipment.

WASHINGTON, D. C.—At a recent meeting of the Columbia Heights Citizens' Association, John R. Gisburne, appointed to confer with the postal authorities relative to the establishment of a street railway system, reported that he had addressed letters to Postmaster Willett, and has been assured that everything possible would be done to establish this system.

KANSAS CITY, MO.—Plans to build the proposed Eighth Street "L" road will soon be revived by the introduction of an ordinance in the City Council granting the Metropolitan Street Railway Company a franchise to construct it. Should the privilege be granted the company will build a surface line from Grand Avenue to Walnut Street, and thence across the proposed viaduct to Wall Street.

INDIANAPOLIS, IND.—The Broad Ripple Rapid Transit Company, a suburban line, has filed a petition with the Board of Public Works asking for right of way into the city. The company now enters over the Citizens' Railway Company's tracks. It also proposes to pay the city $500,000 for a franchise through all the streets in 1901, the date of expiration of the present franchise of the Citizens' Company.

YOUNGSTOWN, O.—It is announced that the Park & Falls Electric Railway Company will increase its capital stock from $50,00 to $200,000. A large force of men will be put to work on an electric road to the coal fields, eight miles south of the city. This field is said to contain 5,000 acres of coal land, and has all been quietly tied up by the company and its friends, and the work of developing will be commenced at once. The railway company has ordered eight motors, each guaranteed to haul 100 tons of coal on cars eight miles an hour, and 100 gondolas.

Personal Notes.

ANNOUNCEMENT of the marriage of Mr. H. Ward Leonard to Miss Carolyn Good, at Geneva, Switzerland, Aug. 24, has just been received. No one has a wider acquaintance or enjoys greater popularity in electrical circles than does Mr. Leonard, and the good wishes that go out to him are as sincere and hearty as they are numerous.

MR. FRANK JUDSON POPE, son of Mr. Ralph W Pope, secretary of the American Institute of Electrical Engineers, has entered the field of daily journalism on the staff of the *Evening Sun*. Mr. Pope, who graduated from Columbia College in the Class of '05, is well equipped for the profession he has adopted, not only intellectually, but in the possession of personal qualities that will commend him to those with whom he comes in contact.

MR ALLAN R. FOOTE has assumed the duties of editor of the *American Exporter*, and the September number, the first issue under his editorial supervision, plainly shows the influence of his versatile thought and broad knowledge. It is the desire of Mr. Foote to make the paper an efficient means for extending the sale of American electrical apparatus and manufactures of every kind in all foreign countries, and in this good work he invites the co-operation of those interested.

Miscellaneous Notes.

THE YOUNG MEN'S INSTITUTE, 222 Bowery, New York, which will hold its opening exercises on Oct. 1, has announced an electrical course for the coming term. Mr. R. H. Mansfield will be in charge of the classes, which will meet on Mondays and Thursdays. The course is designed to meet the needs of young men engaged in, or desirous of entering upon, the various branches of electrical work. Instruction will be given in the theory and underlying principles of electricity and magnetism, and the practical application of these principles in the design and operation of electrical appliances. The first part of the term will be devoted to a study of the units of potential, current resistance and energy, followed by a description of the methods of their measurement and of the measuring instruments, primary and storage batteries, electrotyping and electroplating, the principles of the dynamo and motor (both direct and alternating current), incandescent and arc lighting, electric railways and transmission of power, telegraph, telephone, testing of apparatus and wiring, measurement and standardizing of lights.

THE HENRY ELECTRICAL CLUB will hold its first meeting on Friday, Oct. 4, at the rooms of the American Institute of the City of New York, 111–115 West Thirty-eighth Street. Hereafter lectures will be delivered on every Friday night, on the following subjects: 1. Principles of Dynamos. 2. Shunt Dynamo. 3. Series Dynamo. 4. Compound Dynamo. 5. Alternators. 6. Armature. 7. Field. 8. Design. 9. Tests on Iron and Steel. 10. Testing of Dynamos. 11. Running and Handling. 12. Methods of Driving Dynamos. 13. Transformers. 14. Switchboards. 15. The Line. 16. Subways. 17. System of Regulation. 18. Interior Wiring, Conduits, etc. 19. Safety and Distributing Devices (Cut-outs, Fuse Blocks, Panel Boards). 20. Circuit Wiring, Sockets, Lamps. 21. Principles of Motors. 22. Shunt Motors. 23. Series Motors. 24. Alternating Motors. 25. Testing of Motors. 26. Troubles in Dynamos and Motors and Their Remedies. One other night in the week, Tuesday, will be devoted to class work, where the members are allowed to ask questions, and such questions are discussed by an instructor. This part of the club is under the supervision of the University Extension of the State of New York, whereby the members are allowed to undergo examinations, and receive, if their knowledge is sufficient, a regent's diploma in due time. The executive committee has thought it advisable that the members of the club should be given a chance to study elementary mathematics, and arrangements have accordingly been completed to have 15 lectures on algebra delivered every second Tuesday, in addition to the class work of that night. It was only after careful consideration that Tuesday was selected for the two kinds of work, but after careful investigation it was found to be inadvisable to have three nights a week devoted to educational work in one club, since the members, mostly workmen, cannot well stand the strain. For further particulars address Mr. Geo. W. Whitefield, the secretary of the Institute, 111-115 West Thirty-eighth Street.

Trade and Industrial Notes.

A NEW CAR BARN has just been completed by the Berlin Iron Bridge Company, of East Berlin, Conn., for the New Haven Street Railway Company. The barn is 86 feet wide and 188 feet long, covered with slate.

H. E. COLLINS & CO., of Pittsburg, Pa., sole agents for the Cahall vertical water-tube boiler, manufactured by the Aultman & Taylor Machinery Com-

pany, of Mansfield, O., have just issued a card containing a list of repeated orders received for Cahall boilers the length of which indicates the great favor with which those boilers are being received.

ONE OF THE NICEST specimens of advertising literature which has been presented to the trade is the new catalogue of the Buckeye Electric Company, of Cleveland, O. Each page not only contains a well-executed cut of a certain style of lamp, but is embellished with unique etchings of designs appropriate to the style of lamp on that page. The book is thoroughly original, and reflects the progressive policy and good taste of its publishers.

THE ROSE ELECTRIC COMPANY, of St. Louis, has purchased from the Municipal Electric Light Company, of that city, the old Gratiot Street electric light plant complete, as it stood when shut down, and including everything inside of the walls of the building. Among other pieces of apparatus are two 80, two 100 and two 150-hp boilers; several 150-hp Russell and 100-hp Buckeye engines, heater, pumps, oil filterers, 3,000-light Slattery alternators and six 500-light alternators.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, has prepared a very complete catalogue of Upton arc lamps, showing a large line of plain and fancy lamps for direct-current series and constant-potential circuits, and alternating-current constant-potential circuits. The company claims to have what has long been looked for in the alternating arc lamp line, and that is a noiseless lamp. The cordial reception given this lamp by the trade at large, the makers think, justifies their high opinion of it, and the strong claims made for it.

NIGHTINGALE, JOHNSON & CO., Utica, N. Y., report that the electrical business in their district is remarkably good, and appears to be increasing steadily. Among the contracts closed by this energetic firm this month are the following: a 300-light iron-armored conduit installation for the Henry Martin Building, a 200-light iron-armored installation for the Munson Memorial Building, a 200-light plant complete for the Foster Brothers Manufacturing Company, wiring for 150 lights for the Utica Cabinet Company, and wiring for 200 lights for Ableths Knitting Mill, all in Utica, and a 100-light plant complete for the Columbia Yarn Mills in Oriskany Falls, N. Y.

THE RECENT HEAVY SALES OF "P & B." tape are construed by the Metropolitan Electric Company, of Chicago, general Western agents, as indicating that its customers concede this tape to be a superior article. All imitations of "P. & B." goods, says the Metropolitan Company, have proven inferior, the "P. & B." still holding its old-time record of excellence. The Metropolitan Company states that the delivery of its new catalogue has been delayed on account of additional matter that has come up, and which will increase the book to 700 pages. This edition will be a huge one and, it is claimed, the largest and most complete electrical catalogue in the world. It is now expected that the book will be ready for distribution by Oct. 1.

BANKERS AND BROKERS, manufacturers and business men generally are using "Universal" telephones according to a goodly number of testimonial letters reprinted in the pamphlet catalogue of the Universal Telephone Company, of Indianapolis, Ind. The unanimous verdict of all these letters is that entirely satisfactory service has been obtained with the "Universal" instruments. The pamphlet describes two classes of outfits, one for lines of 4,000 feet or less, and factory installations; the other for longer distances and more general service. The company manifests its faith in the apparatus by its guarantee to replace any working parts which within five years prove defective by reason of imperfect workmanship or inferior material, which is certainly a strong argument.

A WELL-EXECUTED CATALOGUE is being distributed by the Cutter Electrical & Manufacturing Company, of 1112 Sansom Street, Philadelphia, makers of automatic magnetic circuit-breakers. The introduction gives interesting and valuable data concerning the disadvantages attendant upon the exclusive use of fuse-wire, including a table showing the discrepancy between the rated capacity and the actual fusing point for wires of all sizes between Nos. 4 and 30. The catalogue proper describes in full detail magnetic circuit-breakers, for direct currents of 110 to 500 volts, and alternating currents of 1,000 to 2,000 volts, the first class including a circuit-breaker for street cars, which would seem destined to have a wide field of usefulness. The instruments are all illustrated by excellent engravings.

A VERY CONVENIENT CATALOGUE of Weston instruments has just been issued by James G. Biddle, of Philadelphia, sales agent for the Weston Electrical Instrument Company. The list embraces voltmeters, ammeters and wattmeters. As these instruments need no special description, the pamphlet briefly mentions them by number and range, and gives the price and code word for each, so that all particulars which a buyer needs are presented without superfluous matter. An admirable feature of the book is a short chapter devoted to methods for measuring resistance with the Weston voltmeter and milli-voltmeter. Diagrams and formulas are given which will prove valuable to the station manager and engineer, explaining how to determine insulation and other resistances by methods much simpler than those which prevailed a few years back.

CHLORIDE ACCUMULATORS are rapidly increasing their sphere of usefulness. Portable batteries of chloride accumulators were used in reporting the yacht races from Atlantic Highlands by the Western Union Telegraph Cable Company, and from the Highlands of Navesink by the Postal Telegraph Cable Company. A decided impetus to the use of accumulators in telegraph work was given about a year ago, when the Stock Quotation Telegraph Company, of New York, installed at its Broad Street office a battery of 100 chloride cells, for use in operating its tickers. The results obtained have led the company to install in its Baltimore office a battery plant of 120 chloride accumulators, which will be used to operate the tickers in that city. The Electric Storage Battery Company, of Philadelphia, manufacturer of these accumulators, recently closed contracts for batteries to be installed as auxiliaries to the private electric lighting plants of Mr. W. Luttgen, Linden, N. J., and Mr. Lewis Jones, Overbrook, Pa.; also for a battery installation for the residence of Mr. John J. Dewey, Quecho, Vt.

THE TANDEM BRAKE COMPANY, Havemeyer Building, 26 Cortlandt Street, New York, has issued a very handsome catalogue illustrating and describing the tandem car brake. In it managers of railway companies are advised to "break away from the old idea" and use "the best brake in the world for electric, cable or steam cars." It is claimed that the tandem brake, which can be applied by air or electricity, combines the ease of application of both the air and the electric brake; only requires one hand to operate, and can be depended upon under all conditions; will hold the car on grades, and, when the rail is bad, "giving the motorman a living chance to save the people's lives and the stockholders' dividends." All interested in brakes should write for a copy of the new catalogue. Mr. Edward B. Wyman, general manager of the Tandem Brake Company, and well known to street railway managers, will be pleased to furnish full particulars to intending purchasers, either by mail or when he sees them at Montreal.

IN DARKEST AFRICA.—Less than two years ago Buluwayo, South Africa, was a thatched town inhabited by a warlike Zulu tribe under the savage Lobengula. A short time has sufficed to turn the kraal into a busy city which has sprung up with mushroom-like rapidity. The city has just ordered from the General Electric Company an electric lighting plant for the illumination of its streets, public buildings and private residences. This contract was captured in the face of the competition of the most noted manufacturers in Europe, whose foothold in South Africa was the surer because it had been planted earlier and was undisputed. The contract was secured entirely on correspondence and solely on the merits of the engineering plans and recommendations. The electrical plant will consist of two high-periodicity simple alternators for lighting service. The lamps will also come from the General Electric Company's works, so that the first work of electrical progress in this newly civilized section of the world will be established by a representative American concern.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED Sept. 17, 1895.

(In charge of Wm. A. Rosenbaum, 177 Times Building, New York City.)

546,303. TROLLEY POLE; R. Crommer, Philadelphia, Pa. App. filed Jan. 29, 1895. A pole having a pivoted rod with a conical point at its lower end and also a bracket, a wheel hung on journals and counter weights for guiding and retaining the wheel upon the trolley wire.

546,308. SYSTEM OF CONTROLLING RAILWAY TRAINS; A. L. De Leeuw, Springfield, O. App. filed Jan. 25, 1894. The combination of moving contact boxes having an electrically locking device, and an electrical connection from the boxes to locking devices in other boxes which are connected in multiple arc.

546,324. DYNAMO TELEGRAPHY; A. S. Harris, Minneapolis, Minn. App. filed Feb. 13, 1895. A transmitting instrument having two sets of contact points, each set being independently controlled by a lever, two sources of current of like potential connected to one set of contacts, and two other sources of current connected to the second set of contacts.

546,357. TELEPHONE; I. D. Smith, Pittsburg, Pa. App. filed May 3, 1895. A spring controlled carrying bar pivotally supported between its outer and inner ends, a toothed disc in mesh with a pinion on the shaft of the generator armature, and a pitman attached to the inner end of the carrying bar and to the toothed disc.

546,383. INSULATOR; G. Gerstenlauer, Williamsport, Pa. App. filed March 27, 1895. An insulator with body of insulating material having a perforation and an open slot communicating, and a plug to fasten the wire in place.

546,388. ELECTRIC ARC LAMP; S. P. Parmly, Chicago, Ill. App. filed Oct. 26, 1891. The combination of two electrodes constituting the opposite terminals of the lamp, each consisting of two or more pencils in electrical connection along longitudinal edges and having feeding mechanism.

546,389. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; H. A. F. Peterson, Milwaukee, Wis. App. filed March 19, 1894. The combination of a plurality of converging conduits, a movable conduit section provided with conductor sections, adapted to be adjusted so as to register with and establish communication between a desired pair of conduits, switch mechanism for starting and stopping and reversing the said adjusting mechanism and also adapted to engage with the conductor section.

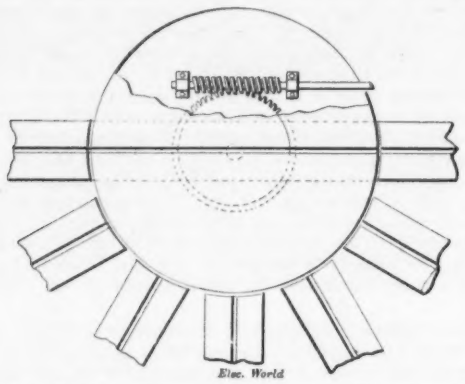
546,403. ARC LAMP MECHANISM; K. A. Lantau and C. J. Anderson, Chicago, Ill. App. filed Feb. 28, 1895. The combination of a block of insulating material secured to the lamp and having a plate mounted thereon, the end of the plate serving as one cut-out, another plate mounted on the back of the first block and forming another contact for the second terminal, and the armature mounted upon the under side of the plate and thoroughly insulated therefrom.

546,407. TROLLEY WIRE BRACKET; L. S. Pfouts, Canton, Ohio. App. filed Oct. 20, 1894. The combination of an arched arm supported at right angles to the trolley wire by an arm secured to the pole and having springs

attached to the said arched arm and a trolley wire clamp located below the arched arm.

546,417. THERMOELECTRIC GENERATOR; H. B. Cox, Hartford, Conn. App. filed Oct. 4, 1894. The combination of two thermoelectric generators having a continuously closed insulated fluid conduit, and a heater for heating the said fluid and a propeller in the said conduit provided with exterior driving means.

546,442. ELECTRIC MOTOR; F. H. Williams, Greene, N. Y. App. filed March 11, 1895. The combination of electromagnets, their armatures, a circuit-breaker consisting of an inferior magnet with its helix connected with the core and with the said magnets, and an electric contact finger carried to and from the core of the inferior magnet by the armature.



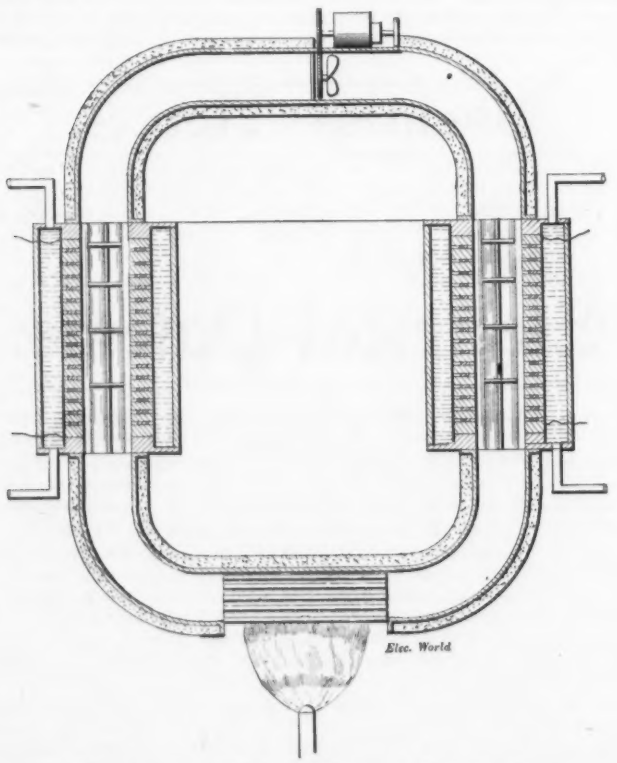
No. 546,389.—UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS.

546,471. CONNECTOR FOR TERMINALS OF ELECTRIC CIRCUITS; J. E. Neher, Pittsburg, Pa. App. filed July 30, 1894. The combination of a plurality of line conductors and a plurality of contact devices, with suitable supporting and insulating means, a soft rubber bed, a plurality of contact devices supported thereby, and means for clamping the two sets of contacts together.

546,475. FUSE BLOCK; H. N. Potter, Allegheny, Pa. App. filed Oct. 17, 1894. A fuse having insulating material surrounding the same, a heating coil surrounding the said insulating material and in series with the fuse.

546,476. ELECTRIC CONVERTER; C. F. Scott, Pittsburg, Pa. App. filed Jan. 12, 1895. A converter composed of a secondary of successive layers, the opposite ends of which are connected in multiple arc to the terminals of the secondary distributing system.

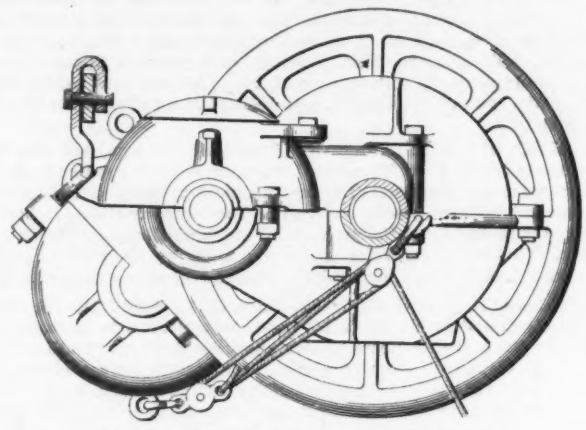
546,494. INSULATING RAILWAY JOINTS FOR ELECTRICAL SIGNALS; T. O'Brien, Jr., Philadelphia, Pa. App. filed July 18, 1895. A wooden stringer supporting the ends of rails, blocks alongside of the rails and metallic chairs secured to the blocks and separated from each other, the bases of said chairs being also separated and adapted to be spiked to wooden ties.



No. 546,417.—THERMO-ELECTRIC GENERATOR.

546,499. APPARATUS FOR SIGNALING VEHICLES BY NUMBERS; F. Warren, New York, N. Y. App. filed Jan. 15, 1895. The combination of a sign consisting of a box longitudinally divided, doors hinged to each face, a continuous pane in the top of each door, having numerals marked thereon, whereby the same are caused to designate the number above, lamps in each compartment and a plurality of lamps at the top whereby the same is constantly illuminated, a switchboard and means for actuating lamps to designate numbers.

546,523. LIGHTNING ARRESTER AND CUTOUT; O. Gieseke, Lake Charles, La. App. filed March 26, 1894. A plug loosely mounted in an opening, an integral transversely-extending tube the interior of which communicates with an exterior reservoir, line terminals inserted in opposite outer ends of the tube, and a body of conducting fluid located in the reservoir and the tube normally forming a connection between the terminals.



No. 546,560.—ELECTRIC LOCOMOTIVE.

546,534. ELECTRIC ARC LAMP; D. Higham, Boston, Mass. App. filed June 4, 1895. A lamp having suitable feeding mechanism, and a carbon clutch adapted to be automatically locked and oppose the series windings of the lamp, when the arc is being struck, but free from action upon the clutch and the opposition to the series windings when the lamp is normally working.

546,546. ELECTRIC RAILWAY SYSTEM; H. M. Montgomery, New York, N. Y. App. filed June 14, 1892. The combination of a continuous supply conductor, a sectional working conductor and an intermediate auxiliary conductor formed of a continuous series of similar magnetic parts in electrical contact for connecting the supply conductor with various sections of the working conductor.

546,551. THERMOMETRIC CIRCUIT CLOSER; R. Pearson, Lordon, Eng. App. filed May 2, 1895. A circuit closing device consisting of a balanced thermometer mounted to oscillate on a horizontal axis, this motion having a tendency to both increase the weight at one side of the axis and at the same time decrease it at the other side of the axis.

546,553. ELECTRIC CALCULATOR; W. C. Potter, Arlington, Minn. App. filed Dec. 1, 1894. In an electric calculator for registering the results of mathematical calculation upon a series of registering faces representing denominations successively of a higher order, means for making and breaking an electric current to advance the numbers on said faces or to reduce them as desired, consisting of a tablet the face of which has a series of conductor surfaces equal to the numbers in each denomination, connected with one pole of a battery and intervened by non-conductor surfaces; and a brush provided with two sets of teeth, one in each set for each of said registering faces, each tooth of one set connected to the other pole of the battery through a separate magnet, each adapted to operate one registering face to advance the numbers thereon, and each tooth of the other set connected in like manner to the same pole through magnets adapted to reduce the number on their registering faces respectively.

546,560. ELECTRIC LOCOMOTIVE; S. H. Short, Cleveland, O. App. filed April 23, 1894. The combination of an electric motor journaled to arms journaled to the driving axle, and gearing connecting the armature shaft and axle, a cross bar yieldingly mounted on the truck frame, and a laterally swinging link for connecting one side of the motor casing and the cross bar.

546,570. INSULATED ELECTRIC CONDUCTOR; F. Clouth, Cologne, Germany. App. filed June 26, 1895. The combination of a covering or layer of caoutchouc surrounding a conductor and a layer of gutta percha surrounding the former.

546,582. ELECTRICAL PIANO; G. H. Davis, New York, N. Y. App. filed June 17, 1895. The combination of a rotary drum, a series of friction shoes mounted above the latter with rearwardly extending arms having a connection with the keys of the piano; an angle bar having a series of magnets arranged upon it, a contact roller having electric connection with the magnets, and electrically connected contact fingers bearing upon the roller.

546,585. INSULATOR; W. Dibb and A. Vickers, Syracuse, N. Y. App. filed March 12, 1895. An insulator having a central cavity in its upper end, slots therein also to receive the line wire, and a plug to press the wire firmly at right angles to its length and to kink it also.

546,611. BILLIARD OR POOL TABLE SHADE AND REFLECTOR; E. F. Gennert, Brooklyn, N. Y. App. filed March 16, 1893. A shade adapted to be fastened above the table, and suitable light fixtures to be secured to one side of the shade and supported thereby.

546,625. ELECTRIC ARC LAMP; H. A. Seymour, Washington, D. C. App. filed July 20, 1895. The combination of an arc enclosed globe and a cover seated directly upon the upper and open end of the same and adapted to move laterally in any direction, the cover being provided with an opening in which the feeding carbon snugly fits and through which it feeds.